Electrical Review

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Selection of Oil Circuit-Breakers

Discussion of Characteristics of Different Types of Breakers, Especially as Applied to Interconnected Transmission Systems

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Correct application of an oil circuit-breaker to an electrical system or circuit requires that certain characteristics of the breaker and of the system of the circuit be known or assumed. The breaker characteristics can usually be determined by tests, and the principal manufacturers of breakers publish these characteristics in convenient tabular form. These characteristics are: (1) Rated voltage, (2) rated current, (3) current-interrupting capacity, (4) maximum momentary current-conducting capacity, and (5) time interval between the instant of short-circuit and the instant the breaker contacts part.

The first three characteristics of the breaker are well known and recognized. The latter two, however, have not, perhaps, been given as much consideration as they merit. The maximum momentary conducting capacity becomes of considerable importance particularly where breakers are applied to a relatively low voltage system which will give high current rushes under short-circuit conditions before the breaker opens, these current rushes being considerably in excess of the current which the breaker may actually interrupt. It has also been found that for breakers designed to have high interrupting ability it is

Installation of Electrically Operated Oil Circuit-Breakers on 73,000-Volt Lines.

not feasible to use contacts too small for continuous current rating, since the mechanical forces set up by the heavy current under short-circuit conditions cause reduction of pressure between contacts with resultant burning of same.

It is obvious that if we have an electric system in which the short-circuit current decreases very rapidly, due to the relatively low resistance of the system, that the current which a breaker would have to interrupt will vary markedly with the time interval elapsing between the instant of the short-circuit and when the breaker contacts start to part. It is, therefore, evident that a breaker which opens instantaneously would be called upon for more severe duty than would the breaker whose opening was delayed. On the other hand, if there is considerable reactance between the sources of energy and the breaker, the decrease in short-circuit current is not so marked, and the interrupting duty called upon is practically the same, independent of the time delay in opening the breaker.

To determine what interrupting ability is required of a circuit-breaker for a given location the r.m.s. current that the circuit-breaker will be required to open must be calculated or assumed. For interconnected transmission systems this determination often becomes complicated, and to arrive at a probably correct value a miniature set-up of the system on a calculating table may be required.

The characteristics of the system which have a direct bearing on the value of the short-circuit current may be summarized as follows: (1) Normal voltage and frequency; (2) total kv-a.

Installation of Breakers on 23,000-Volt Lines.

reactance and transient characteristics of the synchronous machines connected to the system; (3) number, reactance, resistance, capacitance and arrangement of all circuits over which power can be supplied to the point of short-circuit; (4) kv-a. arrangement, resistance, reactance and capacitance of all reactors and transformers through which power can be supplied to the point of short-circuit; (5) contact resistance at the short-circuit; (6) nature of the short-circuit, whether single phase or polyphase; (7) kv-a. and power-factor of the load being carried at the time of short-circuit; (8) point of the pressure wave at which the short-circuit was established, and (9) the use of automatic voltage regulators. For practical approximate selection of breakers it is permissible to use only the reactance of the various pieces of apparatus and transmission lines and an accepted group of time current decrement curves for synchronous apparatus.

Circuit Characteristics Influencing Choice of Breakers.

Except in the case of very long transmission lines, the resistance drop may be neglected, as this is in quadrature with the reactance drop, and its effect is only a few percent of the total result. Furthermore, short-circuit currents so calculated are higher than would actually be obtained; consequently, a more conservative breaker application is obtained than would otherwise be the case. In a like manner, the capacitance of the system can almost invariably be neglected even in underground cable systems of moderate size. This effect, of course, tends to neutralize the reactance drop, and theoretically tends to reduce the reactance of the system. Time current-document curves are shown in the *Proceedings* of the American Institute of Electrical Engineers, Feb. 8, 1918, in a paper entitled "Rating and Selection of Oil Circuit-Breakers," by Messrs. Hewlett, Mahoney and Burnham.

These curves have been based upon the following assumptions: (1) Transient characteristics for alternators of normal design determined from oscillograph tests; (2) that the effect of capacitance and resistance is neglected; (3) that the contact resistance at short-circuit is zero; (4) that the alternator is carrying full load at 80% power-factor, and (5) that the effect of automatic voltage regulators is neglected.

Where breakers are located on the secondary side of a stepdown transformer bank, and the capacity of this transformer bank is small compared with the amount of synchronous apparatus on the system, it means that the voltage on the primary side will, in all probability, be maintained for a short-circuit on the secondary side. Consequently, the amount of short-circuit current can be determined directly from the reactance of the transformer without giving consideration to the reactance of the rest of the system. In other words, if the percentage reactance of the transformer expressed in terms of the total generator kv-a. capacity is 150% or more, it will only be necessary to consider the transformer by itself and determine how much current it will pass. This is, of course, obtained by multiplying the normal secondary current of the transformer by 100 and dividing by the percentage reactance.

There are several ways of calculating the probable short-circuit current. One is to use the percentage reactance method, expressing all reactances of apparatus, transmission lines, etc., in equivalent percentage of the total system generator and synchronizing apparatus capacity, and, where two or more circuits are in parallel, ob-

taining the equivalent reactance of the parallel circuit. By adding all reactances in series the total reactance from the generators to the point of breaker application is obtained, and the short-circuit current factor can then be obtained from the time current-decrement curves previously referred to.

Where the interconnections are particularly complicated and there are several cross connections and paralleled circuits, it usually works out better to reduce all portions of the system into ohmic reactance values, and then apply Kirchhoff's law to determine the equivalent of reactance of the total system. The value in ohms reactance may then be expressed in percentage reactance, based upon the total kv-a. capacity of synchronous apparatus and the proper multiplying factor obtained from the time current decrement curves.

The factors indicated on these curves are high enough to cover both single and three-phase short-circuits on three-phase ungrounded neutral systems, or where the neutral is grounded through a limiting resistance or through only one machine of several feeding the system.

For single-phase short-circuits on solidly grounded neutral three-phase systems, the initial current is slightly higher and the sustained current approximately 100 to 150% higher than the values indicated on the curves. For full protection in such cases allowance should be made accordingly in choosing a breaker for such a system.

Single-phase and two-phase systems will have essentially the same short-circuit characteristics as those referred to.

Cable systems require more consideration than overhead systems. Cable faults are generally progressive and may start the relay and develop into a dead short-circuit at the time the breaker contacts part. Where full protection is desired for such cases a breaker good for the initial value of short-circuit current that can occur on a particular system, as indicated by the time current-decrement curves previously mentioned, should be used.

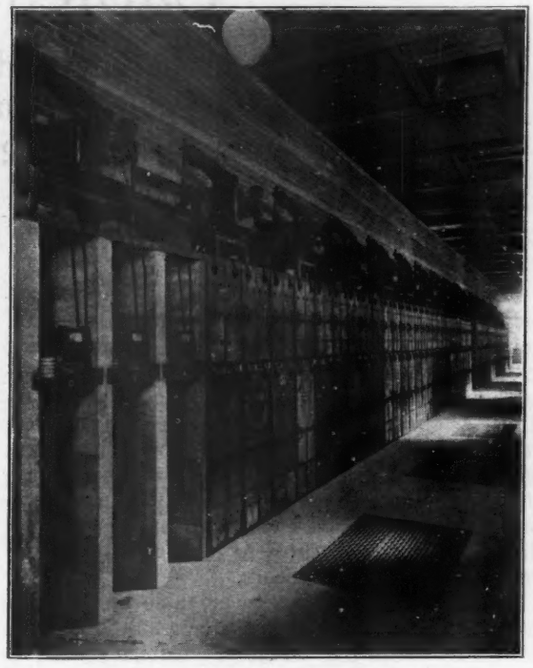
Discussion of Different Types of Breakers and Their Applications.

Application of non-automatic breakers may be based on breaker interrupting capacity ratings and the two-second system short-circuit characteristic on the transformer bank short-circuit current value. This is based on the logical assumption that a non-automatic breaker will not be opened by an operator in less than two seconds after the occurrence of a short-circuit.

When two-pole breakers are used between line and a solidly grounded neutral without limiting resistance, they should have a voltage rating equal to the voltage between outside wires, but the interrupting ability when so applied may be in amperes, that given in the manufacturer's table of circuit-breaker ratings for a voltage corresponding to that between line and neutral or 58% of the phase voltage.

When breakers with series trip coils are used they should be so applied that the short-circuit current to which they may be subjected will not exceed the ampere values given in manufacturer's tables for interrupting ability or the one-second greatest current-carrying capacity values.

These breakers have in themselves considerable reactance which limits the short-circuit current that can pass through them. Therefore, when using a breaker of this type on secondaries of distributing transformers, advantage should be taken of the breaker reactance.



Typical Oil Circuit-Breaker Structures.

A convenient formula for the short-circuit amperes is obtained by multiplying the line voltage by 0.58 and dividing by the sum of the ohms reactance of the transformer, breaker and per wire of line.

NEW STORAGE BATTERY MADE UP OF BRIQUETTED PLATES.

A new type of storage battery is described in a recent issue of *Science Abstracts*. This new battery, which is of Swedish origin, appears to be a modification of the nickel-iron alkaline cell as made by Jungner, the chief characteristic being the method of making up the plates from briquettes of active material, which are automatically fed in between two perforated nickel-steel strips. These strips inclosing the active material are manufactured in lengths folded together and fitted into a steel frame. The complete electrode is then put through a rolling process to insure perfect contact between the active material and the strips. Only a brief indication is given of the methods followed.

MUNICIPAL ELECTRICIANS TO HOLD ANNUAL MEETING.

The twenty-fifth annual convention of the International Association of Municipal Electricians will be held at New Orleans, La., Oct. 19-22, and early indications promise a large attendance at the convention. Clarence R. George, Houston, Tex., is the secretary of the association and has charge of the convention arrangements.

Stresses in Suspended Wires and Cables—Part I.*

Solution by Means of Laws and Equations of the Catenary of the Fundamental Problems in Connection With Transmission Line Stresses Resulting from Weight and Sag of Suspended Wires

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High-pressure electrical power transmission has increased the necessity for reliable information pertaining to wire and cable spans of increasing lengths. The crossing of wide streams with suspending and conducting cables constitutes of itself a special problem, replete with interest from the mechanical engineering standpoint, while the now common method employing high steel towers and spans of considerable lengths, in ordinary high-tension electrical transmission and distribution, has features to be carefully considered by electrical engineers.

A suspended chain, wire or cable under ordinary conditions assumes a shape or curve that conforms with the so-called "catenary" curve. This form of curve is assumed by the suspended wire or cable regardless of the relative heights of the points of suspension; they may or may not be in the same horizontal plane. For present consideration it will be advisable to assume the two points of support to be located in the same horizontal plane. It is common practice to assume that the curvature of a suspended wire or

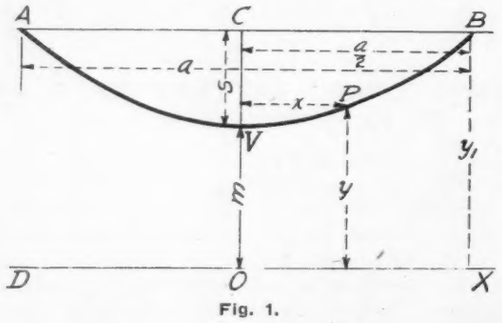

Fig. 1.

cable is that of a parabola, which assumption introduces no serious errors into computations when the sags are small as compared with the spans. If, however, the sags are comparatively large, as is becoming more and more common in engineering practice, the mathematical laws pertaining to the parabola are no longer applicable without introducing serious errors into computations.

Mathematicians and others seem to tend to the opinion that the parabola is more convenient to discuss and that the law of its mathematics is less complex than is the case with the catenary. The discussion throughout this article will, therefore, be based upon the laws of the catenary. The catenary curve is represented by Fig. 1 in which the two points of support, A and B, are assumed to be in the same horizontal plane, and the vertex or lowest point of the curve is designated by V.

The actual weight of a suspended wire or cable, as a whole, depends upon its length and upon the weight of a unit length. The unit weight in common practice is the weight of 1 ft. of the wire or cable, and is usually designated by ω. The weight of unit length of the cable, obviously, depends upon the size of the wire or cable, while the total weight of a wire or cable between two fixed supports depends upon the sag or deflection of the suspended wire or cable as well as upon its size and the distance between supports. The greater the sag of the cable, the longer it will be, and, therefore, the greater its total weight.

Tension at Different Points in a Cable.

Any suspended wire or cable is subjected to a certain tension at every point of its length, due to its weight, which tension varies from point to point. For any given span-distance and sag the tension is a maximum at the supports, a minimum at the lowest point and has intermediate values for the points between. For any given span-distance the tension at each point, such as at the point of support, undergoes important variation with varying sag.

If the wire or cable has an infinite sag, that is if it has infinite length, the tension at the point of support will be infinite and the element of wire nearest the support has to sustain an infinite weight. If the suspended wire or cable has zero sag, it must be subjected to an infinite horizontal tension. Somewhere between these two extreme values there must be a certain sag at which the tension at the support will be a minimum. These conditions are illustrated graphically by Fig. 2. It will be instructive to find the particular value of sag that will render a minimum, the tension at the support in any suspended wire or cable.

Conditions for Minimum Tension in a Cable.

The general equation for the tension at any point in a wire or cable has been found to be $T = \omega y$, in which T denotes the tension in pounds, ω the weight, in pounds, of a foot of the wire or cable, and y the ordinate of the chosen point. Referring to Fig. 1, if the tension at the point of support B be designated by T_1, and the ordinate of the point of support by y_1, then the following equation must be true:

$$T_1 = \omega y_1.$$

It has further been shown that for a catenary

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the ordinate of any point, such as P, may be expressed by

$$y = \frac{m}{2}(e^{x/m} + e^{-x/m}),$$

in which m denotes the so-called parameter, x the abscissa of the point of which y is the ordinate, and e denotes the base of the Napierian system of logarithms, having a numerical value

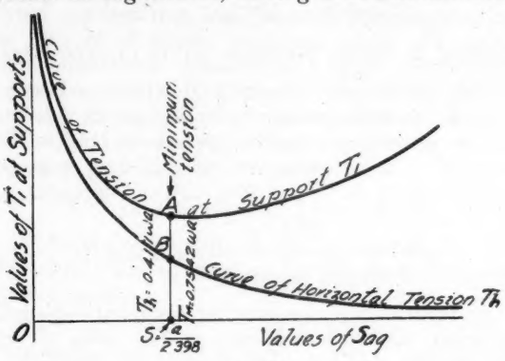


Fig. 2.

of 2.71828. If the abscissa of the point of support be denoted by $a/2$, a representing the horizontal distance in feet between the points of support, the tension at the support may be designated by

$$T_1 = \frac{\omega m}{2}(e^{a/2m} + e^{-a/2m}).$$

This is an equation containing but two variables, T_1 and m, and the problem resolves itself into finding that particular value of m which will render T_1 a minimum. After finding this particular value of m, it will be possible to find the corresponding value of the sag S, of the length L, and of the tension T_h at the lowest point of the wire or cable.

The first operation will be to find the first differential coefficient as follows:

$$dT_1 = \frac{\omega}{2}(e^{a/2m} + e^{-a/2m})\,dm + \frac{\omega m}{2}\left(-\frac{a\,dm}{2m^2}e^{a/2m} + \frac{a\,dm}{2m^2}e^{-a/2m}\right)$$

$$\frac{dT_1}{dm} = \frac{\omega}{2}(e^{a/2m} + e^{-a/2m}) - \frac{a\omega}{4m}(e^{a/2m} - e^{-a2/m})$$

Equating the first differential coefficient to zero gives

$$\frac{\omega}{2}(e^{a/2m} + e^{-a2/m}) = \frac{a\omega}{4m}(e^{a/2m} - e^{-2a/m}),$$

from which

$$\frac{a}{2m} = \frac{e^{a/2m} + e^{-a/2m}}{e^{a/2m} - e^{-a/2m}}$$

This is the critical value which, if substituted in the equation expressing the tension, will render the tension either a minimum or a maximum. In order to ascertain whether this critical value renders the function a maximum or a minimum, it will be convenient to find the numerical value of $a/2m$. This may be done by trial, substituting different numerical values for $a/2m$ until one is found that satisfies the equation. If it be made equal to 1.199, then

$$1.199 = \frac{2.71828^{1.199} + \frac{1}{2.71828^{1.199}}}{2.71828^{1.199} - \frac{1}{2.71828^{1.199}}}$$

$$= \frac{3.31902 + 0.30129}{3.31902 - 0.30129} = \frac{3.62031}{3.01773}$$

$$= 1.199 \text{ (very nearly)}.$$

If $a/2m = 1.199$, then $m = a/2.398$.

Since the critical value, $m = a/2.398$, must render the tension T_1, either a maximum or a minimum, and since the maximum value of T_1 is ∞, if the critical value be substituted in the equation expressing the tension, and the result does not make T_1 infinite, then it must render T_1 a minimum. Making the proper substitutes in the tension equation,

$$T_1 = \frac{\omega m}{2}(e^{a/2m} + e^{-a/2m})$$

gives

$$T_1 = \frac{\omega a}{4.796}(e^{1.199} + e^{-1.199}) = \frac{\omega a}{4.796}(3.62031) = 0.7542\,a\omega,$$

which, not being infinite, must represent the minimum value of T_1. The point of minimum tension is indicated at point A on the curve shown in Fig. 2.

Practical Application of Minimum Tension Conditions.

To show the application of this result to a practical case, suppose the horizontal distance between two supports on the same level is 4801 ft., and the unit weight of cable is 6.1 lbs. per ft. Then the minimum possible tension at the supports will be $T_1 = 0.7542 \times 4801 \times 6.1 = 22{,}087.57$ lbs. It will now be of interest to ascertain the value of the sag, in terms of the span distance a, when the tension T_1 is a minimum.

The sag is expressed by $S = y_1 - m$, being the ordinate of the point of support less the parametric distance denoted by m, as shown in Fig. 1. Making the proper substitutions to conform with minimum tension conditions, the following is obtained:

$$S = \frac{a}{4.796}(e^{1.199} + e^{-1.199}) - \frac{a}{2.398}$$

$$= \frac{a}{4.796}(3.62031) - \frac{a}{2.398}$$

$$= 0.7542a - 0.4170a$$

$$S = 0.337a \text{ (very nearly)}.$$

It will now be possible to find the length L in

terms of the span distance a, when the tension is a minimum. The general expression for the length of a catenary curve is,

$$L = m\,(e^{a/2m} - e^{-a/2m})$$

and for conditions of minimum tension

$$L_m = 0.4170a\,(e^{1.199} - e^{-1.199})$$
$$= 0.4170a\,(3.01773)$$
$$= 1.258a.$$

This, therefore, means that, when the length of any suspended cable is 1.258 times the span-distance, the tension at the supports will be a minimum.

Minimum Horizontal Tension.

In order to find the expression for the tension at the lowest point of a cable which is installed under minimum tension conditions, the general expression for tension, $T_1 = \omega y$, may be employed.

For the lowest point of the curve, y equals m in value, as may be seen from an inspection of Fig. 1. Then $T_h = \omega m$, and, for conditions of minimum T_1, $T_h = 0.4170a\omega$, which condition is shown at B in Fig. 2.

In the case assumed, $a = 4801$ and $\omega = 6.1$. Then

$$T_h = 0.417 \times 4801 \times 6.1 = 12{,}212.30 \text{ lbs.}$$

For this particular cable the tension at the lowest point would be 22,087.57 — 12,212.30 = 9875.27 lbs. less than the tension at the points of support when installed according to minimum tension conditions.

Variation in Horizontal Tension.

Since the tension at the lowest point of a suspended cable is expressed by $T_h = \omega m$, it is evident that, as m increases, the value of T_h will also increase for any given wire. That is, as the sag or deflection of a given cable increases, the horizontal tension T_h decreases so that with infinite sag, since then $m = 0$, the horizontal tension becomes zero. When the sag is zero then m becomes infinite, the horizontal tension becomes infinite and equal to the tension at the supports. It is of interest to note that, while the horizontal tension varies from infinity to zero, the tension at the support varies from infinity down to a minimum and again to an infinite value. This condition is illustrated in the two curves presented in Fig. 2.

Maximum Spans Possible.

From the minimum tension values, it is possible to ascertain the maximum span that can be installed employing any given material, the three important materials employed in practice being steel, copper and aluminum. A comparison of the maximum spans possible for these three materials will be valuable in making suitable selections for specific purposes.

Suppose Siemens Martin steel, having an elastic limit of 60,000 lbs. per sq. in., is to be used. A wire of this material 0.5 in. in diameter will weigh 0.667 lbs. per ft. If the allowable tension is to be the elastic limit value, the value of $0.7854 \times 0.25 \times 60{,}000 = 11{,}780$ lbs. for the elastic limit of the 0.5 in. diameter wire must not be exceeded. The fundamental tension equation, $T_1 = 0.667y_1 = 11{,}780$, still applies.

Then $y_1 = \dfrac{11{,}780}{0.667}$ and, since for minimum tension $y_1 = 0.7542a$, the span distance becomes

$$a = \frac{11{,}780}{0.667 \times 0.7542} = 23{,}419 \text{ ft.}$$

Maximum Span Possible with Copper Wire.

The elastic limit of copper is about 40,000 lbs. per sq. in., and a copper wire 0.5 in. in diameter will weigh about 0.748 lb. per ft. in length. The tension to be allowed is $0.7854 \times 0.25 \times 40{,}000 = 0.19635 \times 40{,}000 = 7854$ lbs. Therefore,

$$a = \frac{7854}{0.748 \times 0.7542} = 14{,}025 \text{ ft.}$$

As indicated above, a is the horizontal distance between the two supports at the ends of the given span under consideration.

Maximum Span Possible with Aluminum Wire.

The elastic limit for aluminum is about 15,000 lbs. per sq. in., and the weight of a 0.5-in. wire is 0.227 lbs. per ft. The maximum span distance is, therefore,

$$a = \frac{2945}{0.227 \times 0.7542} = 17{,}203.5 \text{ ft.}$$

In connection with the subject of maximum span possible for any given material, it is well to observe that the maximum span is entirely independent of the cross-sectional area of the suspended wire. A round wire of steel that is 0.001 in. in diameter may have the same maximum span as a round wire of the same steel 1 in. in diameter. The tensile strength increases in direct proportion to the increase in cross-sectional area, which exactly balances the increase in the weight per foot due to the increase in cross sectional area. If the weight of a piece of any kind of wire 1 ft. long and 1 sq. in. in section and its allowable strength per sq. in. in tension is known, the maximum span may be computed.

Economic Conditions Attending Minimum Tension.

While topographical conditions may allow minimum tension conditions to be realized in practice, it has certain economic limitations that should not be lost sight of. It may, for example, be desirable to install a cable between two mountain peaks that are 10,000 ft. apart, each peak being 5000 ft. high. Under such conditions, if steel wire is used and a sag in accordance with minimum tension is allowed, the following is true: The sag will be 3770 ft., which allows a clearance of (5000 — 3770 =) 1230 ft. beneath the lowest point of the cable; the steel may be assumed to weigh 0.283 lb. per cu. in., that is $\omega = 12 \times 0.283 = 3.396$ lbs.;

$T_m = 0.7542\omega a = 0.7542 \times 3.396 \times 10{,}000$
$= 25{,}612.5$ lbs. per sq. in.

This allows for a considerable factor of safety,

if the elastic limit of ordinary steel is taken as 60,000 lbs. per sq. in. If such a cable were installed in warm weather with a sag in excess of the minimum sag value, but of such value as not to produce a tension in excess of a suitable fraction of the elastic limit, then a decrease in temperature producing a contraction of the cable, reducing its length and sag, will result in a diminished tension. Should the temperature range be sufficient to cause contraction enough, so that the actual sag becomes less than the minimum value, the tension of course increases again. If such a suspension were installed in a level country and a clearance of 30 ft. allowed between the ground and the lowest point of the suspended cable, it would be necessary to have supporting towers (3770 + 30 =) 3800 ft. high.

USE OF COPPER FOR LONG SPANS.

If hard-drawn copper cable should be employed in place of steel under the preceding conditions, then

$$T_m = 0.7542\omega a = 0.7542 \times 3.864 \times 10{,}000.$$

This value amounts to 29,142.2 lbs. per sq. in., the weight per sq. in.-ft. of hard-drawn copper being 3.864 lbs. If the elastic limit in tension for hard-drawn copper is 40,000 lbs. per sq. in., the factor of safety is evident.

The method adopted in many long-span installations is that of employing steel cables which serve to support copper conducting cables. By increasing the height of supporting towers and allowing greater sag, the copper cables alone might be sufficient mechanically as well as electrically.

COST OF CABLE.

Since, for minimum tension conditions, the actual length of the suspended cable is expressed by $L = 1.2584a$ (very nearly), the length of cable to be purchased, to hang between the supports, must be 1.2584 times 10,000, which equals 12,584 ft. This would obviously be expensive and either more supporting towers would be installed or the sag lessened with an attending increase in the tension and a smaller factor of safety.

For any given span distance, reduced cost of installation must be purchased at the expense of factor of safety in the suspended wire or cable.

MODERNIZING OF THE STATIONARY POWER PLANT.

Ideas and Data on Power-Plant Operation Taken from Paper Presented Before Convention of the American Railway Association.

Our national fuel bill is increasing in alarming proportions, not only because of its financial size, but also because the total consumption has reached a point where production is scarcely able to meet the demand. Transportation facilities are inadequate during the periods of maximum consumption. The total quantity of fuel used per year in stationary plants amounts in round numbers to 225,000,000 tons or to 40% of the country's total consumption. This is about 15% more than that used for locomotive purposes.

Under favorable operating conditions there are large unavoidable losses as well as quite large avoidable losses, those encountered between the coal pile and the boiler exceed all the preventable losses between the boiler and the moving machinery. The greater portion of these losses are to be found within the furnace. For the purpose of passing on the performance of various types of boiler installations, a curve and table was presented showing the following figures as the average evaporation that should be secured from and at 212 deg. F., per lb. of combustible:

Type of Boiler	Evaporation
Water tube, stoker fired	10 lbs.
Water tube, hand fired	9 lbs.
Return tubular, stoker fired	8 lbs.
Return tubular, hand fired	7 lbs.
Locomotive, hand fired	5 lbs.

If evaporation falls below these limits it is suggested that an examination should be made to determine the cause, and that steps be taken to bring about better conditions.

Differential draft gages, thermometers and CO_2 apparatus were named as essential to the economic control of boiler equipment. This apparatus can be made to locate many of the causes of low efficiency, and can be used to determine when such defects have been properly remedied. Feed-water heaters, mechanical stokers, heat insulation and good maintenance practice were given as vital factors in the modernization of old power plants.

ELECTRIC PUBLIC UTILITIES ARE LIKE GOLD MINES.

Electric public utilities have often been likened to "gold mines" in the popular version. Now comes Harold N. Lawrie, economist for the American Mining Congress, with proof of the analogy. It seems that gold mines are limited to $20.67 an ounce for the price of the precious metal they produce. Electric public utilities have been limited to very low rates until communities and public service commissions began to give relief. Both gold mines and utilities have faced greatly increased operating costs.

"Gold mines now face the same malady as did the electric public utilities," says Mr. Lawrie. "They are being closed down at an alarming rate because of the fixed price of that which they sell and the greatly inflated price of that which they buy, such as labor, materials, etc. The gold producer finds the actual purchasing power of an ounce of gold is now $9 instead of $20.67. The result is that gold production in the United States in 1919 was only $58,500,000, or 42% less than the $101,000,000 production of 1915. The only difference between the gold situation and the utility problem is that the latter doesn't have to upset the whole monetary system of the nation and possibly cause international complications in order to get an increase in the selling price of its commodity."

BROOKLYN EDISON CO. NAMES TWO NEW OFFICIALS.

At a meeting of the board of directors of the Brooklyn Edison Co., held June 21, E. A. Baily was appointed treasurer of the company to succeed the late Henry P. Erwin, and E. W. Kells was appointed secretary to succeed Mr. Baily.

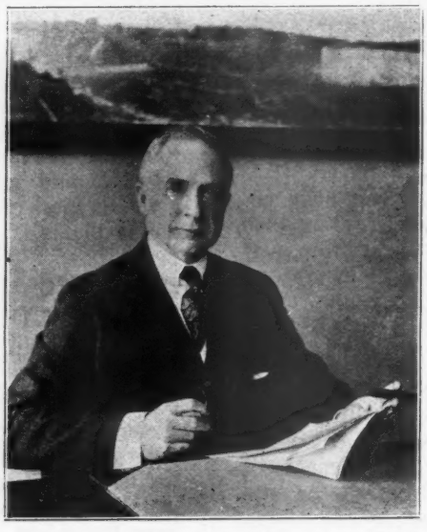
An Engineering Analysis of the Labor Problem

Excerpts from an Address on Relations Between Employers and Employes Delivered Before the Annual Convention of the A. I. E. E. at White Sulphur Springs, W. Va., This Week

By CALVERT TOWNLEY

President, American Institute of Electrical Engineers.

It is prescribed that the president must deliver an address at the annual convention. It has been sometimes customary for the executive who is about to retire from office to summarize the achievements of his term, but it has seemed to me that these have been better chronicled as they occurred in the pages of the *Journal.* The pastime of prophecy has some attractions, but it is of very doubtful value and is somewhat dangerous as well.



Calvert Townley.

Advances in the art are well covered by the many valuable technical papers of the year, including those submitted at this convention. There remain broad public questions regarding which engineers are peculiarly well qualified to have opinions and to influence the opinions of others, and it has therefore seemed to me that I might perhaps come nearer justifying the constitutional provision by dealing with one of these.

One of the most important problems which the American people now have to solve is that of the relations between the employer and the employe classes, generally referred to as capital and labor. A large measure of our national success will depend upon this solution, since engineers are even more directly affected by, and, therefore, more intimately connected with, industrial prosperity than are the other professions, such as the law, medicine and theology, it is obviously their duty to assist in the solution of the problem as much as they can. Although this subject has been voluminously discussed by numberless people for a long time, it has usually been treated from the standpoint of what ought to be, according to the views of one or the other of the interested parties. Questions of justice and injustice, of legality, of the so-called "rights" of labor and the "protection" of capital and of expediency are brought in. There is one angle from which, so far as I know, it has not been treated, and that is from the standpoint of what is instead of what ought to be; that is to say, from the engineering standpoint, one of fact, human nature and of economic laws as contrasted with the laws enacted by man. It, therefore, may be opportune to offer a contribution from this viewpoint, with the belief that the direction of the attention of the members of our organization to the fundamentals of so important a question may serve to clear away some of the fog which always seems to becloud the view.

To begin with, the first law of nature is self-preservation. It is manifested in its highest form as patriotism and in its lowest as sordid greed. Between these two extremes appear all forms of selfishness, many of them by no means blameworthy, others under control or not infrequently dormant, but nevertheless certain to manifest themselves when circumstances compel. Selfishness is the actuating motive in barter; it leads the seller to try to sell at the highest price and the buyer to buy at the lowest. Barter and trade are at the foundation of industry, and, having been always recognized as essential to prosperity, have been encouraged and protected. This form of selfishness has acquired great respectability, but while the practice of matching wits in trade is supported by the people of all lands, the sanctity of contract is also fundamental, i. e., that form of selfishness which leads to the violation of an agreement once made is everywhere decried and condemned. It has been demonstrated that selfish human nature will assert itself and that good faith cannot be relied upon; therefore, recourse has been had to another powerful trait—that of fear. The exercise of the police power, with its penalties for transgression, is based on fear of the consequences.

The ideal condition for barter is where both parties are absolutely free agents and neither, therefore, under duress. Although such a condition is seldom realized when the duress becomes so extreme as to constitute oppression, the desperation of the oppressed may be counted upon to devise resistance. Just as surely as political oppression has throughout all history

led to political revolution so has commercial oppression caused commercial revolution. Too great power, if continued long enough, will always be abused, and, just as such power in government becomes tyranny, similarly too great advantage in barter begets commercial robbery. These statements sound like platitudes and I should hesitate to repeat them were it not for the fact that they not only bear directly on the present situation between labor, capital and the public, but seem to be so frequently forgotten or ignored. Please remember that I am not blaming or praising anyone; I am trying to recite cold facts and to call things by their right names.

Relation Between Employer and Employe.

In the time-honored barter between employer and employe, the employer formerly held the strategic position. If he refused to pay the wages demanded by any individual there was usually someone else willing to accept a lower rate, and the unemployed one, not being mobile and usually having to work to live, was soon forced to yield. As business concerns grew larger this advantage naturally increased, and just as naturally the employers' power was abused. The resulting oppression became sufficiently acute to provoke general resistance and the labor union came into being; workmen banded together to eliminate competition among themselves. It should be noted that the establishment of unions did not suspend the operation of the law of supply and demand; rather did it allow that law freer play by counterbalancing the power of the union against the previous strategic advantage of the employer. The effect was generally beneficial because it corrected an evil, and the general public, while not particularly interested, looked on approvingly.

But early in their history the unions made a serious, although not a surprising, blunder. They set up a system of contracts between employer and employe, and, because they could escape doing so, provided no means by which the workmen could be penalized for violation except by the union itself. This flagrant flouting of a fundamental did not for a time have any serious effect, but the blunder once made was never thereafter corrected, and it is probable that even today it would be difficult to find a labor leader who could be made to see the seriousness of this mistake, much less to endeavor to rectify it.

I pass quickly over a long period of years after the first organization of unions, during which unionism had its ups and downs and came to be regarded, if not with equanimity, at least with tolerance by the employer class, to the recent period of the world war. Then an entirely new condition was created; an imperative demand for men came up almost over night. It simply had to be satisfied at no matter what price. At the same time not only was the supply diminished by those required for the armed forces but immigration stopped as well. The effect on the price of labor was axiomatic—it rose. The unions, being the vehicles through which the demands of many classes of workmen could most readily be expressed at once, became active. The law of supply and demand was fighting on their side and they made the most of it. Wages and prices rose to unprecedented figures. Labor had too much power; its demands had to be met whether or no, and, of course, the power was abused. Then the unions made another mistake. They credited too much of their successes to their organization and failed to appreciate the part played by the law of supply and demand; also, they underestimated the power of resistance which would be engendered by oppression. In their turn they became the oppressors, insistent and arrogant. Where their principal weapon, the strike, was not effective against the employer class in one industry they enlisted the workmen in other industries, and who had no grievance, in sympathetic strikes. They asserted their power to dominate the public convenience, safety and health in order to coerce their opponents into submission to their will. Were it necessary I could recite many specific instances to prove this fact, but I assume it to be so generally known and accepted that a recital would be superfluous.

Now this is the condition today and is one which has caused much grave concern and has produced many strange ideas. We hear that a new order of things has come to pass; that the "rights" of labor must now be respected; that the workman will hereafter have a greater share of the products of his toil; that he must share in the management of industry and have a recognized place in government, and the like. To my mind, the facts warrant none of these assumptions. There is no new order; economic laws are the same as they always have been; they are as ruthless and as inexorable as are the laws of physics. Neither has human nature changed. The unions are in the saddle, but, to use a hunting expression, they are riding for a fall. Please let me remind you again that I am not blaming the unions or anyone else. I am trying to confine myself to statements of fact and to logical opinions based thereon according to the precept and training of the engineer. Suppose that we analyze the fundamentals.

Rule of Majority Will Prevail.

In our system of government where every man can vote and have his vote counted and with our multitude of newspapers informing everybody what is going on, there is little chance that a condition can arise such as that of China or Russia or even of Germany. Further, while we talk a great deal of politicians and parties, we know that on any really vital question the people are going to make up their minds themselves and will elect men who will carry out the wishes of the majority. In other words, the great majority rules.

The number of workmen in labor unions is variously estimated to be from 10 to 40% of the men employed in trades where there are unions. These figures represent the extreme claims of the contending parties. We shall probably not be far wrong if we take a compromise figure of 20%. In the largest class of all, the farmer, there are no unions, and, similarly, none in many other avocations, so if we consider the total voting strength of the country the percentage of men in unions is certainly not over 10% and probably not over 5%. Of this small proportion a few are the leaders, a larger number enthusiastic followers and the great majority

largely governed by conditions. By that I mean they are loyal unionists when the union is succeeding, but desert on small provocation when it is defeated. This is almost obviously true, because the workmen are banded together to accomplish selfish purpose and no other. The individual workman cares no more for his fellow as a class than does the employer. It follows, therefore, that a union must continue to succeed or it will disintegrate and disappear. The history of the last 30 years has recorded many once-powerful unions even the names of which are now almost forgotten.

Capital Gets Little Sympathy from Public.

The moneyed class never has had and probably never will have much sympathy or co-operation from the general public for the very obvious reason that the general public is jealous of them. Sympathy goes naturally to those who are worse off. The moneyed class, being better off than the great majority, therefore come in for sympathy with a minus sign, that is, jealousy. An incentive which will induce the public to oppose the unions can, therefore, be sufficient only when the reason is strong enough to overcome this jealousy. That reason becomes sufficient when the need for self-preservation is made clearly apparent.

The temper of much of the daily press has changed and where formerly there was much said about the so-called "living wage" and criticism of "capitalistic greed" there now appear articles about the vicious cycle of mounting wages and costs, "loafing on the job," and the "need to teach the people thrift and economy." These and other signs are merely symptoms of the incentive to resistance that may be expected to be superinduced by oppression. The aroused public would not be just to the unions, and an attack once thoroughly launched might be expected to go further than it should. However, I am not here discussing justice or how either party should behave, but rather what they have done in the past, and under the pressure of human nature and economic laws most certainly will do in the future.

Whether or not an aroused public does curb union domination, the present high-wage era will not be radically affected. That is a condition controlled not by the unions at all, but by the law of supply and demand. Even the complete abolition of the unions, while it might check further wage increases and perhaps bring about some recessions, and while it would reduce living costs somewhat by cutting out interruptions and tend to increase production, would not itself either increase the supply of workmen available nor decrease the demand for their services. Indeed, while I have discussed the fundamentals of barter between the employer and the employe and have endeavored to show the natural reactions resulting from barter with either party under duress, it is not at all certain that conditions will become so extreme as to bring about the reaction described. That is to say, instead of the abuse of power by the unions being curbed by the organized opposition of other classes of our people, it may be reduced or even thwarted by the law of supply and demand.

Lest I may be misunderstood, I might here state that because I have been confining myself to a discussion of the relations between the employer and the employe and have had much to say about the employe's abnormally high wages, I do not want to be understood as giving that condition as the only cause of the prevailing high prices. Advantage has very generally been taken of the opportunity to increase profits by those who had wares to market, which is only another way of saying again that selfishness is a universal trait of which no class or classes have a monopoly. A bettering of conditions may be affected by a decrease in the demand for or an increase in the supply of labor. Already there is a marked reduction in the sales of certain products resulting from an unwillingness or the inability of many people to pay the exorbitant prices asked. Government reports of falling exports indicate that the expected lessening of the foreign market for our high-priced products is approaching, and it is not at all unlikely that this may be followed by heavy increases in our imports which will displace American made goods. This result may come about both because foreign nations are getting into their stride of production again and because the high prices prevailing here have naturally created an attractive market. A combination of these and other conditions will reduce the demand for our products and consequently for the workmen to produce them. The immigration authorities of the port of New York report their facilities overtaxed to handle the large numbers coming to our shores, and say that even those numbers would be far larger if there were only more ships to carry the people who want to come. It is natural to suppose that as the heavy burdens of after-war taxation are brought home to the foreign people an increasing percentage will seek to escape them by coming here to live and also that the general restoration of transatlantic shipping to its normal schedules will afford the greater facilities thus demanded.

Engineers Can Help to Allay Unrest.

If my analysis of the facts is correct it is clear that the present domination by organized labor is temporary and also that the era of high prices will pass. Therefore, no material permanent change in either our social order or in our industrial structure is to be anticipated. In the contest between brains and brawn, waged since the world began, brains have always won, and brains always will. Free play for the natural forces of trade may be counted upon to exercise a beneficent influence and it should be hampered and interfered with by government restrictions as little as possible. We cannot, of course, determine from history or from any facts at hand how long a time it will take for conditions to become normal again, but what we need now is clear thinking, courage and patience. I know that we can rely on the engineer for clear thinking, and I haven't the slightest doubt about his courage, but I am not so sure about his patience. You should be leaders of thought in your several circles. You can help to allay much of the present anxiety about the so-called unrest and the apprehension as to the future; therefore, I feel warranted in asking you to give your closest consideration to the subject matter of the foregoing.

Future Trend of Public Utility Financing

Industrial Growth Dependent Upon Utilities—Re-establishment of Credits Through Net Earnings—Financing by Means of Local Investors—Paper Before the North Central Electric Association

By HENRY D. THRALL
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In view of the fact that present financial conditions are without parallel in recent years, and that today's status may be changed by tomorrow, the following is confined to financial conditions as they affect the public utilities, especially the light and power companies, of the country and the future trend of utility financing.

Attention is called to the inflation which has taken place in this country within the last year. The federal reserve system was constructed with a view of being large enough to always take care of the credits of the country and at no time during the period of the war was its capacity overtaxed. However, immediately after the armistice the United States entered upon a program of commercial expansion unparalleled in history. It was the ambition to wrest at once from all competitors a large portion of foreign trade; at the same time, home demands were unprecedented along certain lines, especially that class of commodities which are generally known as luxuries—particularly the automobile trade. There was a steadily growing demand for capital, partially due to the expansion of trade and partially due to the decreased purchasing power of money, which greatly increased the costs of doing business.

These demands have now reached their peak, and the credit machinery of the country has been unprepared to carry this unexpected overload; consequently, the reserves of the banking system have been materially reduced. At the present moment financial institutions find themselves in the position of forcing liquidation for the purpose of checking this expansion in certain lines and also for the purpose of allowing the development of other industries perhaps more necessary for the good of the people, and whose development must be given earnest consideration if the country is to show a well-balanced growth.

Growth of Public Utilities Necessary to Industrial Development.

One of the principal industries of the country coming under this head is that of the public utilities. Industrial growth cannot take place merely through financial acceleration. There must at all times be a corresponding increase in materials, men and machinery power. The public utilities have been called on more and more of late to furnish the necessary sinews controlling this industrial machinery, without the ability on their part to satisfy this demand satisfactorily. The enormous demand for capital due to industrial growth and the unprecedented earnings of many corporations extending over some period of years has bid up the price of free money to a point where those interested in public utilities must necessarily give careful and earnest thought to the present and future needs of their companies. In addition, there are certain internal conditions of the public utilities of this country that add to the burden.

All different classes of industry seem to have cycles of extreme prosperity and cycles of depression. For example, railroads were at one time in a most desirable position; financing was easy; it was easy for them to get concessions of various kinds for extension purposes, terminal requisites and the like, and the whole country seemed to unite in furthering the demands of the railroads. The same has been true of the street-railway, gas and electric light and power companies.

Credit of Public Utilities Very Good Prior to 1916.

Until 1916 the credit of the public utilities was as good as that of any other corporations in the country; franchises were readily obtained; light and power facilities were still in the novelty stage in a great many communities; earnings were good; money was easily borrowed on long-time securities at from 5 to 5.5%; issues of good light and power companies were in demand all over the country; there was a great deal of exploitation; companies were bought up everywhere, developed and resold to more comprehensive holding corporations.

A condition of this sort is always dangerous, as it finally results in an over-expansion and in abuse of credits. Eventually this happened to some extent. The market was over-saturated and in some few cases corporations took advantage of their borrowing opportunities—made loans on their prospective profits rather than actual earnings—and the great investing public turned to new fields for outlets for their money. At the same time the politicians began a concentrated effort to reduce rates, talk of municipal ownership was heard everywhere, and credits fell still lower.

Fortunately, however, earnings of the light and power companies have, on the whole, not declined; in fact, the trend as shown by statistics is an increase. This increase is not, however, sufficient to justify the re-establishment of credits in the eyes of the public.

There are two usual forms of credit advances

to public utility companies, namely, the bond and short-time note.

A review of the public utility bond situation in this country shows that until 1918 it was easy for a sound corporation to get long-time financing done on a 5 to 5.5% basis. Many of the 5% bonds of well-known utility companies were selling even at a premium, whereas those same bonds may today be selling on a 7% or even higher percentage basis.

An excellent example of this is shown in the case of the Commonwealth Edison Co. of Chicago first-mortgage 5% bonds, which up to 1917 sold as high as 103⅝ and which in the last few weeks have sold as low as 78, a range of from 4¾% to 7%. The Commonwealth Edison Co.'s earnings have shown over three times interest charges for the past seven years and the rating and salability of this security is of the highest. The decline in price is not entirely due to market conditions. A great deal of the change is due to the fact that the people know that in order to keep up with the growth of the country vast sums of money must be spent in the next few years on utilites, that they cannot maintain their present condition without the expenditure of these amounts and that in the face of existing conditions it would be impossible to finance future expenditures on a paying conservative basis.

Financing of Construction Becomes More Difficult.

A few years ago it was quite customary to finance construction on a large and well-managed property on a basis of 80% of cost. Interest at 5% was the usual rate on first-mortgage bonds. Twice the interest charges were assumed to be sufficient margin of safety for loan purposes. Assuming that cost of construction and interest rates have gone up proportionately since that time, a corresponding interest rate today would be at least 7%. Therefore, based on this proposition, if cost of construction is increased proportionately to the cost of money, 140% would be the cost of construction today as compared with the old cost. Of course, these proportions are used merely for the sake of the example, because, as a matter of fact, those who have had anything to do with construction recently know that a 40% increase in construction costs is much too low. If, at the present time, one were to loan 80% of the cost of present construction it would mean a loan of 112% of the cost of construction four years ago. Consequently, with any reduction in present construction prices, the bondholders might not have any equity left in the value of the property. At the same time, if 7% interest is to be paid on the bonds 1.4 times the old net earnings must be shown in order to have twice interest charges and this must be shown for several years past.

It is true that net earnings of the utilities of the country as a whole have probably increased to some extent. However, the large increase has unquestionably been with the hydroelectric companies and not with those companies that generate with steam. This differentiation must be borne in mind in considering the general increased net earnings. The hydroelectric companies have been especially fortunate in their position during this period of high cost of production by coal. Furthermore, it is very questionable whether the amounts set aside by the corporations for maintenance, renewals and depreciation have been increased proportionately to the rise in costs, so that it is very doubtful as to whether the average net earnings of light and power companies show an actual increase.

The balance left after interest is all the funds that a company has available to take care of proper sinking funds and to pay dividends. This amount should be greater today than ever before because of the increased risk of doing business.

Net Earnings Must Be Several Times Interest Requirements.

The bondholders always want to know that the stockholders are well taken care of. It is not their desire to run any chance of becoming the operators of the company. In view of these conditions is it surprising that the bond buyers of public utilities as a class, who in the main are individuals, have turned their attention to those securities that can show net earnings of several times interest requirements for a period of several years past?

High money rates always tend to shorten the maturity of issues; consequently, the most popular recent form of financing has been securities in so-called short-term note issues maturing usually from one to ten years.

Public utilities, through necessity, have in some cases financed themselves by a certain amount of these short-term notes. In the opinion of the banker, however, they are not a legitimate type of financing for utilities. The presumption of any note is that it will be paid when due and most industrial corporations who have financed this way have been in position to meet maturities either through liquidation of assets or through earnings. The public utility, however, has nothing with which to liquidate. Its holdings are presumed to be continuous and the issuance of short-time notes in any except limited quantities means that they are merely a makeshift and will have to be refunded at maturity or converted into some other form of security. This is a dangerous procedure, especially under the conditions through which the country has recently passed, since there is at the present time a very effective blockade on the avenues for credit financing of utilities. In addition, the cost is prohibitive.

The most practical method left for obtaining money at the present time seems to be through ownership securities. By ownership securities is meant stocks, either preferred or common. In the early days, before the period of exploitation, this was the usual method of financing companies, and perhaps under present conditions it is the best method to pursue. The logical type of financing is the preferred stock, ordinarily a very customary method. However, the preferred stock market has also been overdone for outside investors and in the open market at the present time it is difficult to underwrite an issue.

There is, however, immense wealth in the Northwest, and if present prospects for crops hold good, there will be a lot more before spring Were the public utilities able to secure a small portion of the funds of Minnesota, North and South Dakota that have gone into oil proposi-

tions, it is believed that the public utilities of those states would find themselves abundantly supplied with all moneys necessary for immediate development. Those are the funds that must be attracted to public utility companies.

Temporarily the financing of utilities by large underwritings in outside markets is in abeyance and central-station companies will find themselves relying upon the local interest of their communities to stand by them and supply the money necessary to build up properties which are such an essential factor in their prosperity.

Customer Ownership Called Blessing in Disguise for Utilities.

It will be a blessing in disguise for central-station companies and the communities in which they operate, for them to have to devise means of interesting local investors in their properties. More than their financial support will be secured; their moral help will be received. Their suggestions will be most opportune and their confidences and influence may be the very means of helping companies over many of their obstacles. There certainly should be much less talk of municipal ownership, complaints of poor service will be reduced, and the communities themselves will be behind public utility organizations to put them in shape to compete with organizations of similarly situated and competitive municipalities.

There is in a neighboring state a city of approximately 15,000 people who have always taken a unique interest in their local industries. Every citizen feels that it is his duty and advantage to try and save money enough to be identified in no matter how small a capacity with some local industry. This feeling has been developed and the means for satisfying it have been furnished by the broad-gage methods of the financial leaders of the community.

As a result of their effort, it is understood that under present market conditions they have been able to sell $300,000 worth of 7% preferred stock at par to local interests for the purpose of certain necessary developments to their light and power property.

Perhaps in order to interest communities it may be necessary to offer something more than a mere promise of, say, 7%. It may be necessary to give them a participating preferred stock, paying them a definite rate of dividends, and giving them an interest in the accrued earnings of the company over and above this amount, or possibly it may even be desirable to sell them some common stock or a combination of common and preferred. But whatever means is necessary to accomplish the purpose will in the end justify the cost.

Proper Management Big Factor in Sale of Securities.

It is safe to assume that the time when property can be purchased with an idea of building it up and reselling it at an immediate profit has passed. Those conditions only exist when there is cheap money. The task before the public utility operator is one of personal application to his property. The management is the greatest element in the success of any proposition and careful efficient management is what the bankers will look for when properties once more command the credit to which they will be entitled.

In the question of management no one thing is of more importance than the careful analysis of earnings statements. It is a mistake for operators to fool themselves with exaggerated ideas of net income. Net earnings of a corporation on paper may show two very different sets of figures. The conservative operator will provide sufficient funds to guard against all contingencies. He will not skimp his depreciation charge, consoling himself with the idea that the value of his property has appreciated sufficiently to offset the usual wear, tear and obsolescence. He will remember that while his depreciation may be figured on original costs nevertheless his replacements may have to be paid for at present prices. Unless the proper amounts have been set aside for this purpose when the day of reckoning comes the statement will disappoint no one as much as it will himself.

The cost of doing business today is much greater than a few years ago. Every company should have an increased working capital. There should be cash on hand in the bank and when it is necessary to make improvements the funds should be on hand before the work is commenced. We can better afford to pay interest for a short time on the amount than to commence work and have it remain unfinished as the result of some unforeseen contingency which may arise.

When a man is loaning his money he wants to know that it is loaned on the best possible collateral. Present high cost of construction is very apt to lower the grade of work done, with the result that at the end of a few years it may all have to be replaced. Extravagant construction should be avoided as much as possible, but excellence is almost a demand.

Public Has Well Defined Duty to Utilities Which Serve It.

The foregoing contains a great deal regarding the duty of the public utility to the community it serves and calls for a word regarding the duty of the people to the utilities of the country. Decrease in the purchasing value of a dollar has caused changes in the costs of operation and the costs of construction and extension of properties. There has been, in fact, an increase in everything except rates. When the public thoroughly realizes that copper costs twice what it did a few years ago, that labor is more than double what it used to be, that the price of coal is rising as fast as the thermometer on a July day; in fact, that one has to pay $2 today for that which previously cost $1, they will at the same time realize that it is not a fair and just proposition for it to pay $1 today for the same amount of that commodity that it paid $1 for five or six years ago. Why should the price of electric service remain stationery when all other commodities have increased so materially?

In a tactful, careful way the public must be brought to realize this injustice which exists at present, and the removal of which more than any other thing will restore the confidence of

investors and re-establish the credit of the public utilities of the country.

The public utility is with us to stay. It serves one of the greatest needs of the people. It has done it efficiently and cheaply. Its future hope for greater things is in the hands of the public, as well as the management, and, with the case fairly stated and facts shown, there is no people that will be more just than the American. Co-operative publicity, combined with square management, a wisely distributed local financial interest, the frank inclination on the part of the corporation to give the community the service necessary for municipal development, will all combine to work out the ultimate salvation of this field.

Industrial development in the Northwest has just begun, and with the continued extension of these great markets various industries are sure to arise in every hamlet and city. The increased living standard of the farmer will demand continually more rural lines. They will all call for more light and more power, and upon the shoulders of the central-station companies rests the burden of developing properties in such a wise, farsighted way that it may be supplied unreservedly, and the development of the Northwest go on apace.

PENNSYLVANIA ASSOCIATION WILL MEET IN PHILADELPHIA.

The Eastern Geographic Section of the Pennsylvania Electric Association will meet at Philadelphia, Pa., July 2, with headquarters at the Adelphia Hotel. The morning session will be occupied with power-factor subjects as follows: "Making Power-Factor as Plain as A B C," by H. R. Smith, of the Electric Machinery Co.; "Power-Factor and Kv-a. Measurements," by W. H. Pratt, of the General Electric Co., and "Power Factor Corrective Apparatus," by Robert Treat, of the General Electric Co. The afternoon will be devoted to a paper by E. C. Stone, of the Duquesne Light Co., Pittsburgh, Pa., on "Effect of Unbalanced Load on the System," followed by discussion and talks by central-station company operators.

THEORY OF METALLIC CONDUCTION OF ELECTRICITY.

A lecture on "Recent Progress in Thermoelectricity" was delivered in London in June before the Institute of Metals by Prof. C. A. F. Benedicks of Stockholm University. He gave a short summary of his theoretical views upon the metallic conduction of electricity which explained many matters not made clear by the former electron theory. A consequence of this new theory was that one has to conclude that even in a single homogeneous metal thermoelectric currents do occur; hitherto such currents were believed to be produced only when two different metals were present.

A concise demonstration was given of the most important experimental evidence of the truth of this conclusion, various metals for this purpose being utilized. In liquid mercury it has been possible to definitely prove the existence of thermoelectric currents, thus disproving the negative results of previous workers. Consequently, what the lecturer termed his "homogeneous thermoelectric effect" was that there must exist the reverse effect, the homogeneous electrothermic effect, including as a special case the well-known Thomson effect. The reality of this effect was duly made clear.

A specially interesting demonstration was given of a new rotating thermoelectric apparatus made entirely of copper and rotating in a magnetic field, the driving force originating solely from unequal heating (by means of a tiny gas jet) of thin strips of copper. The point at which the knowledge brought forward might have some practical interest lay in the possibility of reducing the thermal conductivity of metals by insulated subdivision into fine wires without impairing the electrical conductivity.

HOLD CONFERENCE IN NEW YORK ON INDUCTIVE INTERFERENCE.

An important conference on the National Electric Safety Code was held at the New York City headquarters of the National Electric Light Association, June 22, at which representatives of the Bureau of Standards, the American Telephone & Telegraph Co. and the National Electric Light Association were present. The conference lasted all day and resulted in an excellent understanding as to the lines along which co-operation may be secured in solving inductive interference problems.

The discussion centered about the situation created by a committee of California public utility representatives compiling rules which differ materially from the National Electric Safety Code. As a result of the conference efforts will be made to adapt the national code so as to make unnecessary the setting up of separate rules or codes to meet sectional conditions or situations.

Those present at the conference were Dr. E. B. Rosa and Dr. M. G. Lloyd, of the Bureau of Standards; H. S. Warren, Kenneth Wilkinson and E. B. Craft, of the American Telephone & Telegraph Co.; A. E. Silver, chairman of the inductive interference committee; W. K. Vanderpoel, chairman of the overhead systems committee; Thomas Sproule, chairman of the subcommittee on the proposed code for the Bureau of Standards, and W. J. Canada, director of the engineering department, representing the National Electric Light Association.

NEW YORK SECTION, A. I. E. E., PLANS MEETINGS.

The New York Section of the American Institute of Electrical Engineers, through its executive committee, has arranged a series of joint meetings to be held throughout the coming year with the Metropolitan Section of the American Society of Mechanical Engineers. The subjects selected for discussion at these meetings will come under the following classifications: marine engineering, engineering education, industrial installations, power generation, steam railroad electrification and industrial relations. The first meeting will be held in October and will be followed by other meetings to be held during the winter months.

Large Turboalternator Built in Foreign Factory

Single-Shaft Single-Shell Turbine Develops Energy to Drive 50,000-Kilowatt Generator—Three-Phase Transformer Has Four Low-Tension Windings That May Be Connected in Series or Parallel

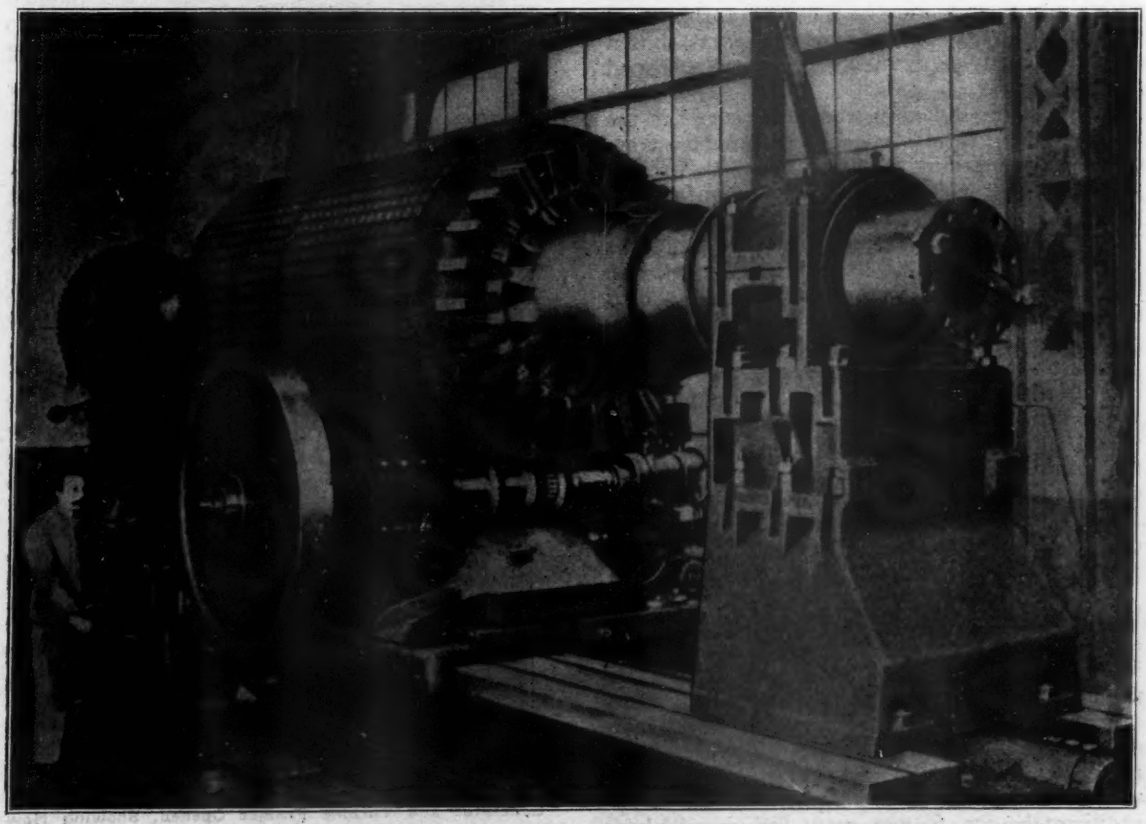
By B. SCHAPIRA

Two turboalternators and two transformers of 50,000-kw. capacity each are being built for installation in the Goldenberg plant of the Rhenish Westfalian Electric Co. These units, which are the largest of their kind under construction, are being built by the Allgemeine Elektrizitats Gesellschaft and one of the complete sets will be ready for service in a short time. The entire turbine capacity will be developed in a single casing, and the electrical output will be generated in a single machine, so that the equipment is actually a single unit rather than a combination of interdependent parts forming a generating group.

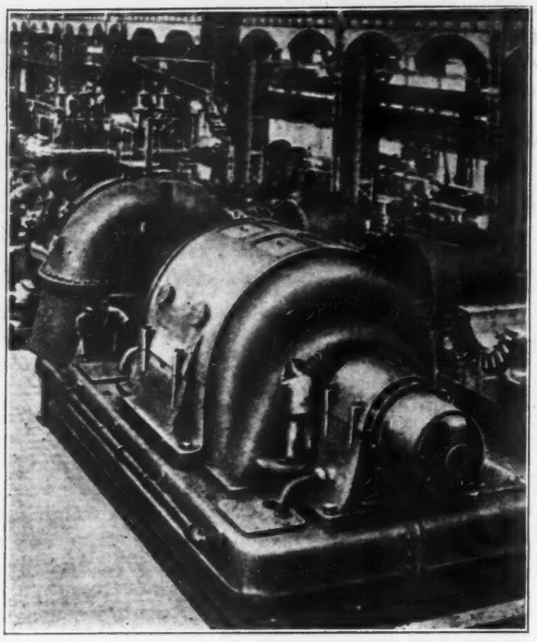
The turbine has a total weight of 250 tons, of which 49 tons is the weight of the rotor. The rotating members of the generator weigh 106 tons and the remaining parts weigh 119 tons, making a total weight of 225 tons for the generator and a grand total of 475 tons for the complete turbogenerator. Parts of these machines are so heavy and of such shape that the transportation to the place of erection required the design and construction of a number of special railway cars. For the generator rotor, a special car with two bogie trucks with five axles each was required. The condensers, which weigh 116 tons each, require a special car having ten axles. There are two condensers, each having a cooling surface of 32,300 sq. ft., for each turbine. The condensers are divided into four sections for convenience in handiing and to facilitate the transportation problem.

General Characteristics of Design.

A general assembly view of one of the turbogenerators is shown in the accompanying illustration as it stands in the shop of the manufacturer. The entire rotating part of the unit is carried on three bearings, the central bearing being developed as a double bearing on account of the heavy load it has to carry. Between the two boxes of the middle bearing, the turbine and generator shafts are joined by means of a flexible



Rotor for 50,000-Kw. Turboalternator Being Slotted to Receive Windings.



General View Showing Turboalternator Assembled in the Factory.

coupling. This coupling may be seen in the illustration showing the machine frames opened up. The turbine body is fastened to and supported by the bearing bodies, so that it can adapt itself without restriction to the expansions and contractions due to operation and temperature variations. On account of this condition the live steam connections have to be of a particularly flexible type and so installed as not to interfere with the free expansion of the turbine case. In addition to the adoption of a flexible turbine suspension, the shape of the unit itself was chosen only after many experiments with various shaped models.

Considerable difficulty was experienced in the manufacture of this type of equipment on account of conditions resulting from the recent war. Blade material had to be manufactured without the use of nickel. The blades as used were cut from solid pieces of metal for all blades where the maximum of strength is required. In this method of construction, only about 15% of the original stock remained in the finished blade.

After assembly the generator rotor was subjected to a test at 1500 r.p.m., or 50% over normal speed, which is 1000 r.p.m. This test was applied in order to be certain that the machine would stand any strains that might result from the failure of both the regular and safety governors during operating trouble periods. Such failures of governors have been known to occur on account of the fouling of certain of the steam-carrying parts.

General Dimensions and Steam Conditions.

The turbine rotor has ten blade wheels varying in diameter from 10 ft. 4 ins. to 11 ft. 7 ins. At the normal speed of 1000 r.p.m. these diameters correspond to a speed of rotation of approximately 540 to 600 ft. per sec. The generator rotor has a maximum diameter of 6 ft. 8 ins., which corresponds to a peripheral speed of approximately 351 ft. per sec. Individual plates assembled to form the generator rotor were tested at a rotating speed of from 2000 to 2400 r.p.m. to assure their freedom from imperfection and their ability to stand up under operating strains.

Steam pressures to be used in these units are below those used in other units built previously in much smaller sizes. Lack of suitable materials, already mentioned in connection with blade construction, was one of the main contributing factors in selecting the pressure and superheat to be used. The turbine design calls for a pressure of 175 lbs. per sq. in., a steam temperature of 615 deg. F., which corresponds to 238 deg. F. of superheat, and for cooling water at a temperature of 80 deg. F. Energy will be delivered by the generator at a pressure of 7000 volts, three phase, and the exciter, which is mounted on the shaft end, will operate at 220 volts.

Transformer Design and Construction.

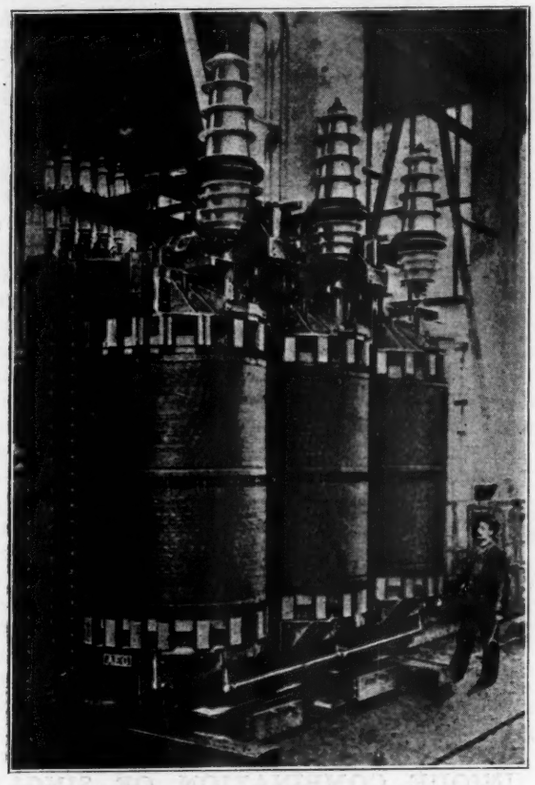
Four separate 6250-volt low-tension windings are provided for each transformer and are so arranged that they may be connected either in series or in parallel. This connection makes it possible to secure 6250-volt, 12,500-volt or 25,000-volt low-tension service from the transformers without other alteration than the rearrangement of terminal connections. A single potential of 110,000 volts will be delivered by the high-tension windings. From the arrangement of windings, it will be possible if desired to relocate these transformers and use them for reducing a line potential of 110,000 volts to any one of the possible low-voltage potentials.

The transformers have a total weight of 116 tons, 66 tons of which is assembled core, 15 tons is casing and 35 tons winding. A laminated sheet-metal alloy, 0.012 in. thick, was used to build up the actual working core, there being

Generator and Turbine Frames Opened, Showing How the Various Parts Are Assembled.

approximately 40 tons of this material in the completed cores. Special conditions of design influenced the selection of an elliptical-shaped cross-section for the cores, which, of course, resulted in the use of elliptical-shaped coil sections.

In the arrangement of coils on the core there are two sections of low-tension winding placed next the core with the numerous narrow elliptical high-tension coil sections placed over them. The



Transformers Designed for Three-Phase 110,000-Volt Service.

two remaining low-tension coil sections are placed over the high-tension coils. Such a coil arrangement has certain advantage in that it utilizes insulation space for oil-circulating ducts and so assists in the uniform cooling of windings. The accompanying illustration shows the transformer assembled, but without being installed in its case. Only the two outside sections of low-tension coils are visible, the high-tension and other low-tension coils being installed between these two sections and the core.

Features of Transformer Cooling.

Oil is used for insulation and for cooling, the oil being circulated through pipes immersed in a large water reservoir to lower its temperature. A pump having a capacity of 500 g.p.m. is used to force the oil through the cooling coils and transformer shell. One of the advantages of this type of cooling is that the oil is always at a pressure above the water pressure, thus insuring against the presence of water inside of the transformer in case of a leak. Other advantages are the elimination of extra parts or obstructions within the transformer shell, a positive regulated circulation of cooling fluid giving a definite control of internal temperature and a reduced size of all parts due to the uniform and definite cooling secured.

An idea of the great size of the transformers is obtained by comparison with the height of the man shown in the illustration. Another comparison is to be had with the high-tension insulators, shown installed at the top of the transformer framework, which are approximately 10 ft. high.

WESTERN ELECTRIC CO. BILLINGS SHOW INCREASE.

Total for First Five Months of 1920 Is $68,200,000, an Increase of 43% Over Same Period Last Year.

Billings of the Western Electric Co. during the first five months of this year were $68,200,000, an increase of 43% over the same period of the previous year. This indicates total sales billed for the year of approximately $180,000,000. It does not include the output of its foreign affiliated factories, which will increase the total to well over $200,000,000, compared with $135,722,000 in 1919 and with $150,340,000 in the record year 1917.

The increasing business is in all lines of its activities and in all sections, and would be considerably greater than above stated if it were not for difficulties in transportation, in supply of raw materials and in shortage of labor. This is evidenced by an increase in unfilled orders from $47,400,000 on Jan. 1 to $79,000,000 on June 1.

The recent financing of the company by the issue of $25,000,000 five-year 7% bonds convertible April 1, 1922, into 7% preferred stock, has enabled it to carry this increasing business with less than a normal use of its banking credit. The bonds, which were issued April 1 at 98½, have consistently maintained a somewhat higher market value since then and it is understood that they were widely distributed in the West as well as in the East.

The bookings have not yet reached the peak, having shown a steady increase since the first of the year. Incoming orders in May were over $20,000,000, billings thus being only about 75% of bookings.

COMMITTEE ON COMPENSATION REPORTS TO COUNCIL.

Congressional Commission on Reclassification of Salaries Proposes Lower Scale Than One Now Prevailing in Some Classes.

In its progress report to Engineering Council, presented June 17, by Chairman Arthur S. Tuttle, the committee on classification and compensation of engineers makes the following statements regarding the report of the Congressional Joint Commission on the Reclassification of Salaries.

"The classification of engineers proposed by the Congressional Joint Commission on Reclassification of Salaries shows that the work of this commission has been guided largely by the work of the committee, and a comparison of its recommendations with those of the committee will be shortly released for publication. It is the belief

of the committee that, to say the least, the federal commission's classification where it differs from that of the committee has no advantage. The compensations for the various positions proposed in the federal report are disappointing, as they do not provide anything like the increases which are believed by the committee to be essential to the end that the engineering profession may attract and retain men of proper calibre to assume successfully the responsibilities placed upon it.

"From the analysis it would appear that in the lower grades of federal service in 16 bureaus the compensations proposed by the federal commission would be from 2 to 19% less than those which have heretofore prevailed, while in the higher grades the increases range from 8 to 17%. The proposed salaries other than those for the grade 'junior assistant engineer' range from 20 to 30% less than those suggested by the engineering committee."

Discussing work to be undertaken, the report states: "It is proposed to undertake a vigorous campaign for the purpose of securing recognition of the classification of various positions as recommended by the committee last year and as adopted by the council on Dec. 18, 1919, and at the same time to secure a general expression of opinion on the part of engineers and heads of services as to the compensation schedule tentatively suggested by the committee."

In addition to addressing communications to the secretary of each of 123 engineering societies in the United States and Canada, "arrangements are being made to secure co-operation on the part of the lay as well as the engineering heads of all services employing engineers and of all civil service commissions.

"The committee is hopeful that the plans which it has laid for continuing its work will bring to its assistance the earnest backing of engineers throughout the country in making the classification effective, and that information as to the value of engineering service and as to a wise employment policy will be obtained from such a wide variety of sources that it will be practicable to formulate definite recommendations along these lines and to set up standards which will insure general respect."

CO-OPERATIVE PLAN FOR STUDENTS PROVES A SUCCESS.

Massachusetts Institute of Technology and General Electric Co. Conduct an Interesting Experiment at Lynn, Mass., Plant.

For the past year an interesting experiment in co-operative electrical engineering education has ben conducted by the Massachusetts Institute of Technology and the General Eletcric Co. While the co-operative scheme in itself is not new, several departures from the usual plan were introduced, which have produced decided results.

The class was limited to 30 students, who were chosen entirely upon the records which they had made in the equivalent of the first two years' work of the electrical engineering course at Massachusetts Institute. Included in this group were graduates from Yale, Harvard, Dartmouth, Princeton, the Naval Academy, besides men who had completed their first and second years solely at the institute. The year is divided into four three-month periods, the students spending alternately thirteen weeks at the Lynn works of the General Electric Co. and eleven weeks at the institute, followed by a two weeks' vacation. The group at Lynn is housed together in an old residence which has been converted into a modern club house. No break is made in the major studies when the students are at Lynn, courses being conducted at the works in principles of electrical engineering and in general studies. The progress of the students through the plant is regulated, not by the production needs of the various departments, but by the advantage which the experience in each department is to the students.

The result of this year's work has been gratifying to the originators of the plan. Because the students were a selected group, were all taking the same course, and were thrown together intimately at work and at the club house, an intense spirit of loyalty to one another, to the institute and to the General Electric Co. soon became manifest and every man strove to make a reputation for the course. With the students attacking the work in this frame of mind, it is not surprising that their enthusiasm was soon shared by the officials and superintendents of the co-operating company, who are unanimous in stating that the work done in the shops has been pre-eminently satisfactory. As evidence of its approval of the work, the company has increased the number of men who can be enrolled in this year's class to 60 and has already secured a new club house in order to furnish rooming accommodations for them. The new class, which has already nearly completed its quota of members, will enter upon the work July 6.

UNIQUE COMBINATION OF SINGLE AND THREE-PHASE SERVICE.

Dual System Provided for Operation of Bascule Bridge Over Sacramento River by Central-Station Companies.

The United States government requires all drawbridges on navigable streams to be supplied with two independent sources of power, and where electricity is available this is usually one of them, a gasoline engine usually being the other.

However, at Rio Vista, Cal., where a new bascule-type brige has been completed over the Sacramento river, both sources of power are electric, writes C. E. Sedgwick in *Pacific Service Magazine,* published by the Pacific Gas & Electric Co., San Francisco. This was possible on account of service being available both from the Pacific Gas & Electric Co. and the Great Western Power Co. at that point.

Each apron of the bridge is operated by a 20-hp., three-phase, 220-volt motor, and each motor has its own control, so that the movements of the aprons are independent of each other, though they are usually operated simultaneously. The large bolts which lock the aprons together when the bridge is closed are operated by two 5-hp. motors, and the gates at

each end of the bridge by 2 hp. motors. All this apparatus is under the control of the bridge operator located in the small operator's house at the west end of the bridge.

As the Pacific Gas & Electric Co. has single-phase service only available at Rio Vista, a motor-generator set was installed in the operator's house to convert the single to three-phase service. This comprises a 40-hp. single-phase motor direct-connected to a 30-kw., three-phase, 220-volt generator and exciter.

By a system of switches power can be supplied to the bridge from either service at will, and changed from one to the other almost instantly, so that the chance of failure in the bridge operation is very remote.

SAFETY PROBLEMS DISCUSSED BY ENGINEERING SECTION.

At the summer meeting of the Engineering Section of the National Safety Council, held in Chicago, June 24, problems having to do with safety in the conduct of manufacturing plants and means of increasing production were discussed by a large number of speakers. The principal paper at the meeting was "How Can We Increase Production," by Sidney J. Williams, chief engineer and secretary of the national council.

HYDROELECTRIC PLANTS ON THE LOS ANGELES AQUEDUCT.

Construction of 18,750 Kv-a. Station in San Francisquito Canyon Nearly Completed—To Utilize Overflow from Aqueduct Reservoir.

The city of Los Angeles, Cal., has under construction a new hydroelectric station, to be known as its power plant No. 2, in San Francisquito canyon, about 40 mi. north of Los Angeles. The site of this plant is about 6 mi. downstream from power plant No. 1, the latter having been in operation since 1916. Plant No. 1 was the first constructed to utilize the water that is conducted from Owens river through the city's great aqueduct to Fairmont reservoir, the latter being situated at the head of San Francisquito canyon.

The aqueduct has a total length of 223.4 mi., and was primarily constructed to provide the city of Los Angeles with an adequate supply of water from a mountain source. The intake is on Owens river, one of numerous streams that feed into the aqueduct system from an extensive watershed on the northeastern slope of the Sierra Nevada range. The headwaters of that drainage area are about 350 mi., as the streams and aqueduct water flows, from the Fairmont reservoir near Los Angeles. Between the Owens river intake and the Fairmont reservoir the aqueduct makes a descent of 3800 ft. The reservoir, which has a capacity of 7620 acre-ft., serves as a storage basin for city water supply, and also acts a forebay for hydroelectric plants The reservoir outlet consists of 26,500 ft. of concrete-lined rock tunnel of the mean carrying capacity of 400 sec-ft., making a drop of 59 ft. in that distance. The outflow is controlled by an outlet tower and regulating gates. Close to the lower end of the tunnel is inserted a concrete-lined surge tank, formed by an excavation in solid rock. The position of the surge tank is just above the point where the tunnel discharges into two steel penstocks, and serves to obviate undue pressure in the penstocks that may result from a change in load. The penstocks leading from the mouth of the tunnel to plant No. 1 have each a 7-ft. diameter and a length of 3600 ft. The entire line of a 26,500-ft. tunnel and two 3600-ft. penstocks constitutes a pres-

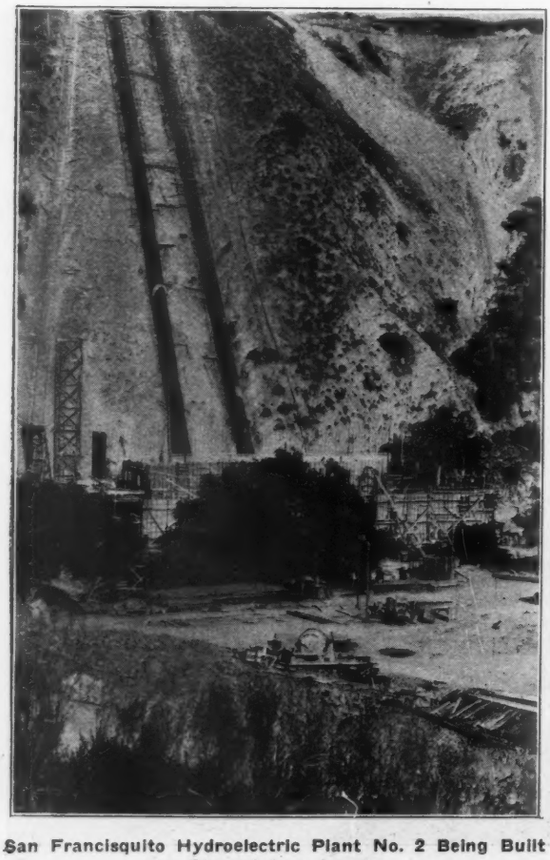
Intake on Owens River of the Los Angeles Aqueduct—Sierra Nevada Mountain Range in Background.

sure system between the reservoir forebay and the power house. The penstocks were designed for a maximum flow of 1000 sec. ft., giving an effective head of 800 to 940 ft.

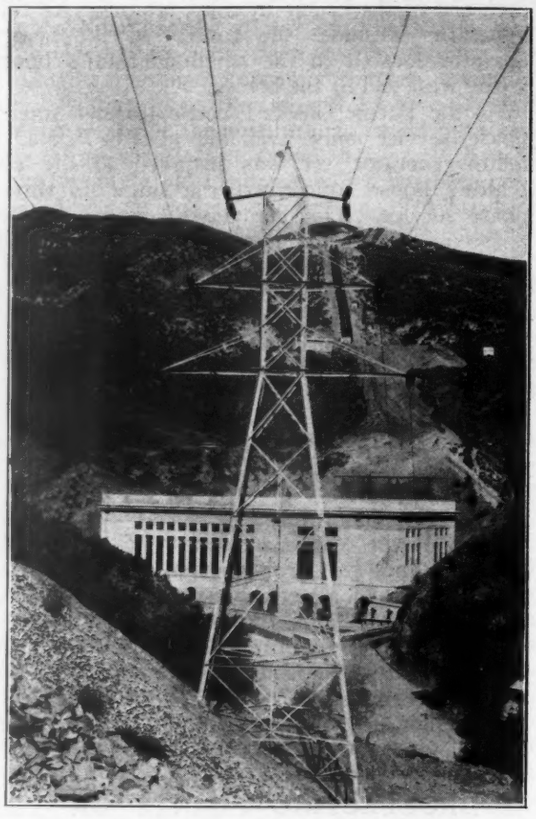
The equipment of plant No. 1, which is housed in a reinforced concrete structure, consists of three Westinghouse 6600-volt, three-phase, 50-cycle, 9375-kv-a. generators driven by 14,000-hp., 200-r.p.m. double-runner, overhung waterwheels. Energy produced here is transformed from 6600 to 110,000 volts for transmission to the Los Angeles receiving substation over a double-circuit steel-tower line.

Power plant No. 2, being constructed at a site 6 mi. farther down the San Francisquito canyon, will utilize the water that passes through plant No. 1. The flow is to be conducted through a tunnel and two 6-ft. penstocks, giving a static head of 535 to 504 ft. at the latter power house. The two generating units being installed consist of two General Electric 17,500-kv-a., 6600-volt, 428-r.p.m. generators direct-connected to and driven by a Wellman-Seaver-Morgan hydraulic turbine of the Francis vertical type. The power house provides room for a third similar unit to be installed at a later date. This two-unit plant is expected to be ready for service by midsummer.

In addition to the above, plans and specifications were prepared for the construction of the San Fernando hydroelectric plant at a site 24 mi. from Los Angeles. This plant is designed to utilize the water passing through plants No. 1 and 2 above described. Plans for it provide for the installation of penstocks which will deliver the water to the turbines at a head of 230 ft.



San Francisquito Hydroelectric Plant No. 2 Being Built by City of Los Angeles.



Plant No. 1, in San Francisquito Canyon, Which Utilizes Water from Los Angeles Aqueduct.

and also provide for the installation of two 3500-kv-a. generating units.

Still another hydroelectric station, to be known as Franklin Canyon plant, has been planned, the site for which is between the upper and lower reservoirs in that canyon. The city's present river power plant, situated at the lower point on San Fernando valley trunk-line siphon, was put in operation in 1917. It is between San Fernando and Franklin reservoirs and is equipped with a 3500-kv-a. unit.

COMING CONVENTIONS.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 13-16. Secretary, D. L. Gaskill, Greenville, O.

Pacific Coast Section of the National Electric Light Association. Annual convention, Portland, Ore., July 21-23. Chairman, R. M. Boykin, Portland, Ore.

Michigan Section of the National Electric Light Association. Annual convention, Ottawa Beach, Mich., Aug. 24-26. Headquarters, Hotel Ottawa. Secretary, Herbert Silvester, Ann Arbor, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 8-11. Secretary, H. M. Stine, 211 Locust street, Harrisburg, Pa.

New England Section of the National Electric Light Association. Annual convention, Kineo, Me., Sept. 13-16. Secretary, O. A. Bursiel, 149 Tremont street, Boston, Mass.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 4-8. Headquarters, Southern Hotel. Secretary, W. H. Morton, 110 West 40th street, New York City.

International Association of Municipal Electricians. Annual convention, New Orleans, La., Oct. 19-22. Secretary, Clarence R. George, Houston, Tex.

EDITORIAL COMMENT

The Economics of Wages

In his address before the convention of the American Institute of Electrical Engineers, Calvert Townley gave a masterful treatment of the fundamental laws of supply and demand as they apply to existing economic conditions in this country. High wages or low wages are items of relatively small importance, provided conditions are uniform throughout the entire economic community. For example, wages and commodity values on an isolated island, not in touch with the rest of the world, are entirely independent of wages and commodity values in other places. In a given section of the general economic body where there is a large supply of money it will be held of relatively small value and prices of all useful or desired commodities will be high, while in a section where relatively a large amount or a surplus of commodities exists prices will be lower. With adequate transportation available, the surplus of commodities, including labor, will flow towards the locations where money is plentiful or cheap, thus smoothing out the variation in values from place to place. Where artificial barriers, such as import and export duties, trade and labor restrictions or inadequate transportation are interposed, the interchange is hampered and gradual, or actually prevented, until such time as the commodity or money supply breaks down the barriers and allows an easier interchange to restore equilibrium.

Much the same condition prevails within a community when real or artificial barriers are interposed upon the free exchange of commodities, including both labor and money, between various individuals or classes. Artificial barriers may hold for a certain length of time or against a certain amount of unbalancing, but ultimately they will be broken down and normal conditions will prevail until the same or other artificial barriers are again set up. Thus the laws of economics hold true in the average, and no hindrance, thus far devised by man, has been able to stand for long against them.

In the end, an average condition of right, or justice, prevails, not because it is right, but because wrong is wrong and cannot prevail. Conditions affecting the labor problem referred to by Mr. Townley may represent one of the ever-recurring turning points in the economic life of the country, to be followed by a period of restoration and balancing of the supplies of labor, money and other commodities. If new barriers are set up or if the balance is so established, after the failure of the old restrictions, that this country has high money values or high commodity values with respect to the rest of the world, then a world-wide interchange will have to be made to finally reach a state of normal equilibrium. The problem in hand is to discover what is right and to carry it through, for a false economic machine cannot continue to function any more than any other falsely designed structure.

The Coal Situation

When the mercury in the thermometer is registering rather high in most parts of the country it seems hard to realize that the greatest worry public utility operators should have is the coal question, for ordinarily at this time of the year the utility operators should be contentedly watching the winter supply of coal pile up in their storage yards.

But such is not the case this year, as reports from all parts of the country indicate that instead of the usual reserve supply being obtained there is an actual shortage of coal right now. A crisis is anticipated within the next week or ten days. Either material relief will have to be secured or the threatened coal famine will be an actuality in many parts of the country.

Where does the blame lie? It certainly does not lie with the utility companies, for they have taken every possible step to protect themselves. One trying to fix the blame runs headlong into a stone wall of either misinformation or else no information at all. There is about the merriest little game of shifting the responsibility ever existent going on, with the railroads and the coal mining companies as the "shifters."

"Don't blame us," say the coal operators. "Blame the railroad companies. They won't furnish us with cars."

"Don't blame us," say the railroads. "We furnish the cars to the mines, but the mine operators load them to consumers other than the public utility companies."

So the utility company is driven from pillar to post and gets nowhere, while the coal pile grows smaller and smaller, and little, if any, relief seems in sight.

But the one outstanding fact remains, and that is that the utilities are not getting enough coal. Figures prove this, not only from isolated sections, but from all parts of the country. Recent

reports from the Illinois mines show that only about 26% of the normal supply of coal cars is being delivered to the mines for loading and shipment. The same figure, approximately, applies for car supply in Indiana and Iowa. Figures for Ohio are a trifle higher.

Again, who is to blame? In any other line of industry when cars for loading of shipments are wanted the industry interested takes steps to get the needed cars. The coal mine operators allow the coal consumers to take all the initiative and do all the work in connection with the obtaining of cars for coal shipment.

It was the National Electric Light Association, acting in co-operation with other organizations representing public utility interests, that was responsible for the Interstate Commerce Commission's recent order providing that, during a period of 30 days beginning June 21, open-top cars of all classes shall be used exclusively for the transportation of coal. It was the utility interests that are primarily responsible for this order being put into effect, and not the mine operators. And is that order being obeyed? Evidence would not indicate that it is. The Interstate Commerce Commission issues such orders but, as a rule, that seems to end the matter.

It is true the order is a step in the right direction, but it is not sweeping enough. What is needed is an order giving priority rights to public utility coal. In this way the shipment of coal to luxury-producing and non-essential industries would be deferred. It has been stated, and, as far as known, not denied by the coal operating interests, that there is discrimination in favor of these non-essential industries, which are willing and able to pay extra prices for coal for immediate delivery, and which, by the very nature of their business, can immediately pass to the public the burden of that increased cost of coal.

The situation is serious and one that threatens forced shutdowns of many public utilities in the middle of summer, when under ordinary conditions supply permits of storage. What then of the winter months? Frankly speaking, the utilities are not in position to consider that angle. They are thinking of it, but they have all the worry they can handle right now in trying to obtain coal enough to keep their plants in operation.

The Interstate Commerce Commission hesitates about issuing a priority order for public utility coal for fear other industries will step in and demand the same rights. On what grounds? If the commission will ask that of other applicants they will have the question settled, for there is certainly no other industry, outside of the two directly involved in the getting of coal to public utilities—the coal operators and the railroads—that are as absolutely necessary and essential to the public as the utilities. The Interstate Commerce Commission should grant priority rights to public utility coal and should do it at once.

Large Turboalternators

It is interesting to note that foreign manufacturers are, at least in certain instances, carrying the development of generating units into even larger sizes than have been found practical in this country. The growth of the central-station industry, through the application of centrally generated power to services formerly supplied by isolated plants, and through the normal growth of manufacturing enterprise, has developed the necessity of generating stations of enormous size. Plants of 500,000-kw. capacity are not beyond the range of possibility. With stations such as are now planned or such as may be planned and built in the near future, large generating units are essential to simplicity of operation. It is impossible to conceive of a plant of 500,000 kw. or even one of half that size being equipped with units of 5000 or 10,000-kw. capacity, such as were considered large only a few years ago. However, with units of 40,000 or 50,000 kw., such stations are possible without having an excessively large number of units.

On other pages of this issue a brief description is given of a foreign-built single-shaft turbogenerator of 50,000-kw. rated capacity. This unit is the first of its kind to be built and, undoubtedly, will be the subject of much study from an operating standpoint when it is placed in service. Limitations in the materials available placed unusual handicaps upon the designer, particularly with respect to the turbine-blade construction. The designer has aimed to overcome this difficulty by adopting special methods of fabricating the parts to make the best possible use of inferior materials at hand. Success under such conditions should point the way to still greater accomplishment when unhampered by unusual restrictions.

American practice has turned in the immediate past towards the development of generating sets of two or more separate machines working together as a single operating unit. This type of construction has the advantage that the entire unit need not always be shut down for repairs to one of its parts, and at the same time permits of the assembling of larger operating units than can be produced in a single-shaft design. The near future should bring the answer as to which of these two types of development will predominate, and undoubtedly the performance of the new unit referred to will lend considerable influence in this direction.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

N. E. L. A. AND BANKERS TO CONFER ON FINANCIAL PROBLEMS.

Executive Manager Aylesworth Arranges Series of Conferences With Chairman of Investment Bankers' Public Securities Committee.

Co-operation of the National Electric Light Association with the investment bankers of America is being arranged through a series of conferences between M. H. Aylesworth, executive manager of the association, and O. B. Willcox, chairman of the public utilities securities committee of the Investment Bankers Association. At a recent meeting of the bankers the following resolution was adopted:

"Whereas, investment bankers are expected to purchase and distribute the securities of public utility companies, which must be sold if utilities are adequately to supply the demands upon them for local transportation, light, heat, power and the transmission of messages, and

"Whereas, the credit of many of the public utility companies will not permit the sale and distribution of such securities, thus interfering with the development of many commercial enterprises, the welfare of many communities and the comfort and convenience of a great many people, and

"Whereas, the credit of the public utilities is largely dependent upon the attitude of the public as expressed through the various governing and regulatory bodies,

"It is hereby resolved by the board of governors of the Investment Bankers Association of America that as steps in the restoration of the credit of the public utilities, term franchises should be superseded by indeterminate permits securing the right to operate under proper regulation during good behavior with provisions for equitable adjustment of rates from time to time, as tending to eliminate controversies which inevitably impair the public service, the credit of the companies involved and the value of their securities. The power of regulation and control of public utilities should be vested in state commissions as tending towards standardization of regulation which is not possible under local regulation. Members of state commissions should be appointed. If commissioners are elected they are frequently embarrassed by political policies and platforms in the consideration of questions which should be decided only on sound economic and financial principles."

ITEMS IN SUNDRY CIVIL BILL OF INTEREST TO UTILITIES.

Two appropriations, aggregating $305,000, in the sundry civil expense appropriation bill passed by Congress are of especial interest to electric light and power utilities.

One appropriation is of $108,000 "for gauging streams and determining the water supply of the United States, the investigation of underground currents and artesian wells and the preparation of reports upon the best methods of utilizing the water resources."

The other appropriation is $125,000, "for a survey of power production and distribution in the United States, including the study of methods for the further utilization of water power, and the special investigation of the possible economy of fuel, labor and materials resulting from the use in the Boston-Washington industrial region of a comprehensive system for the generation and distribution of electricity to transportation lines and industries, and the preparation of reports thereon."

ELECTRICAL ENGINEERS MEET IN ANNUAL CONVENTION.

Many Delegates in Attendance at Thirty-Sixth Annual Gathering of American Institute at White Sulphur Springs, W. Va.

A comprehensive analysis of the labor situation from an engineering standpoint was the keynote of the address of Calvert Townley, president of the American Institute of Electrical Engineers, delivered at the opening of the thirty-sixth annual convention of the Institute, held at White Sulphur Springs, W. Va., June 29-July 2, with headquarters at The Greenbrier. Excerpts from President Townley's address are printed on other pages of this issue.

The convention was attended by members and guests of the Institute from all parts of the country, who spent the mornings in attending the technical sessions of the convention and the afternoons in enjoying athletic sports and other entertainment provided by the committee.

Technical Papers Grouped.

The technical papers were grouped as far as possible so that only one general subject was considered at each session, Tuesday, June 29, being devoted to the address of the retiring president, Mr. Townley, and the introduction of the new president, Arthur W. Berresford, of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., who takes up his duties on Aug. 1.

Reports in printed form were presented by the committees on electrochemistry and electrometallurgy, electrical machinery, protective devices, instruments and measurements, telegraphy and telephony, transmission and distribution, iron and steel industry, industrial and domestic power, marine, lighting and illumination, power stations, electrophysics, and traction and transportation. Those who presented the reports were Alexander C. Lanier, D. W. Roper, Frank V. Magalhaes, E. B. Meyer, W. C. Kelb, Arthur Parker, H. L. Hibbard, C. E. Clewell, Philip Torchio and F. W. Peck, Jr.

Many Take Part in Discussion.

Considerable time was allotted to a discussion of the reports in order that the committees might get the benefit of the experience of the members and learn their opinions about the work done. Most of the discussion, however, centered on about half of the reports. That of the commit-

tee on instruments and measurements was discussed by Chester I. Hall, of the General Electric Co. He said that a great many people use measuring instruments under the supposition that they are infallible because they are on the market. That they are fallible is indicated by the recent paper on the oscillograph.

In discussing the report of the committee on transmission and distribution, William A. Del Mar, chief engineer of the Electric Cable Co. and the Habirshaw Electric Cable Co., expressed the opinion that too much emphasis has been placed on dielectric losses. In order to produce cable with ability to minimize these, other important characteristics of cables have been sacrificed. In his opinion the mechanical properties of cables are of principal importance. Recently manufactured cables have failed because of inability to withstand bending. Mr. Magalhaes said that lightning arresters may be justified in large installations. Others who discussed the report were W. J. Hoar, American Telephone & Telegraph Co., and Philip Torchio, New York Edison Co.

Extent of Co-operation.

In the discussion of the report of the iron and steel industry committee, President Townley raised the question of the extent to which the Institute should co-operate with other societies devoted to a specialized branch of the electrical industry and science. Prof. D. C. Jackson, of the Massachusetts Institute of Technology, stated that the question has been raised for some time but that it is acute now. His idea of the field of the Institute is that it lies somewhere between the purely scientific and purely commercial organization. W. A. Del Mar said that it should form a liaison that would connect the specialized societies. Oberlin Smith, president of the Terracide Machine Co., advocated a scheme of federation of the different engineering societies, and Philip Torchio said that if everyone would do more work, the Institute would become attractive to non-members. B. C. Dennison, of Carnegie Institute, Pittsburgh, Pa., explained the proposed amalgamation of the Pittsburgh engineering societies, and E. H. Martindale, of the Martindale Electric Co., explained the arrangement by which engineers of Cleveland have consolidated.

Others who took part in the discussion were D. W. Roper, Commonwealth Edison Co., Chicago; F. G. Austin, Standard Electric Service Co., Minneapolis; A. W. Berresford, Cutler-Hammer Manufacturing Co., Milwaukee; Ernest V. Pennell; Henry R. Summerhays, General Electric Co.; and C. A. Copeland, consulting engineer, Los Angeles, Cal. I. M. Stein, Leeds & Northrup Co., Philadelphia, Pa., called attention to the fact that the iron and steel industry is taking large quantities of electrical measuring devices.

Plan Code for Ocean Ships.

Several discussed the report of the marine committee. This report, which contains a recommended code for the installation of electrical apparatus on ships, contains 80 typewritten pages and is intended to be applicable to all ocean-going ships. At present no rules exist for regulating this important work and it is felt that a standard code is necessary as a protection to those who travel abroad. The rules are a refinement of a set to which the U. S. Shipping Board has agreed. Those who discussed the report were W. I. Middleton, Simplex Wire & Cable Co.; R. A. Beekman, General Electric Co.; W. J. Hoar, and C. A. Copeland.

STOKER MANUFACTURERS NAME NEW OFFICERS AND COMMITTEE.

R. Sanford Riley, Incoming President, Makes Statement as to Policies of Organization for the Coming Year.

At a recent meeting of the Stoker Manufacturers Association held at Lakewood, N. J., the following officers were elected for the ensuing year: R. Sanford Riley, president; M. Alpern, vice-president; A. G. Pratt, treasurer, and J. G. Worker, secretary. The officers with S. A. Armstrong and H. A. Hatton make up the executive committee of the association, which will meet in New York City at an early date and name the standing committees for the coming year.

In regard to the policies of the organization for the coming year President Riley said:

"I have always believed that the stoker business is a good one, but it has not even yet taken its proper place in the business world. I have seen it develop from a very crude business, conducted on a comparatively low plane, to a large business conducted on a much higher plane. We are getting an increasingly large percentage of able men in the business which makes it good not only for those in the business but also for our customers. After all, we can profit only as we serve and the service possible by our business is one of the greatest in any line of business.

"We are no longer the leading propagandist in the art of conserving fuel. The government seems to have taken over that position and all we have to do now is to live up to the demands made of us. Our field is being enlarged every day by economic pressure, and my hope is that we, as an association, may conduct ourselves so as to be worthy of the field."

Mr. Worker, in explaining the usefulness of the association, said: "As soon as real live business men get together in any sort of a meeting and their personal efforts are directed towards a common cause, nothing but a definite constructive program can be expected. Just such a meeting was the beginning of the Stoker Manufacturers Association. The fact that 99% of the stoker manufacturers of the United States are members of this association is significant. The functions of a modern trade association are to furnish information and service to its members that they could not very well get outside and help to educate them, their members and their customers. Associations stimulate the members to improve the quality of their product and the service that they render and the tremendous influence for the industry as a whole is exerted by those associations that maintain a high standard and refuse admittance into the association of any concern who does not come up to the association standards. Whenever any real constructive measure is adopted by the

association every one interested in stokers, including manufacturers, salesmen and customers, are helped. One of the things that the associations are doing and going to do is to have every real stoker manufacturer of the United States a member of the association, and emphasize by the character of the association the fact that the association stands for honest merchandising and for putting the stoker business on the highest level of business ethics."

"GET-TOGETHER" DINNER A SUCCESS IN PITTSBURGH.

More Than 600 Persons Representing All Branches of Electrical Industry Gather for Reorganization of Pittsburgh Dealers.

More than 600 persons, representing nearly every electrical manufacturer, jobber and contractor-dealer in Pennsylvania, were gathered together in Pittsburgh on June 23 in what is said to have been one of the largest electrical get-together dinners and meetings ever held on this continent. The meeting was part of the two-day conference of the Pennsylvania State Association of Electrical Contractors and Dealers. At this conference the electrical contractor-dealers of this district were reorganized and the Pittsburgh section of the state and national association was formally inaugurated.

There were four speakers at the dinner, each touching on the particular phase of electrification and the possibilities in the near future. M. C. Turpin, assistant to manager of the department of publicity of the Westinghouse Electric & Manufacturing Co., talked on "Electricity Today" and showed the wonderful things which electricity has done to make the country what it is today.

H. B. Kirkland of the American Wiremold Co., presented statistics on why there would be a two-billion-dollar merchandising business for 1920. Some of the figures which Mr. Kirkland gave were that there will be sold in this year 1,200,000 vacuum cleaners, 1,800,000 electric washing machines, 1,000,000 electric fans, 3,000,000 electric portable lamps, and 14,300,000 wiring devices.

Col. L. T. Peck, Argentine manager of the Westinghouse company, talked in place of Samuel Adams Chase, who was absent on account of ill health. Colonel Peck told about conditions in South America and said that in Buenos Aires 80% of the houses were wired for electricity. Electrical dealers' show windows, Colonel Peck said, were changed every week and the dealers were fully alive to the merchandising possibilities of displaying their goods in the most effective way to the public.

The address of W. L. Goodwin created considerable interest because of the definite manner in which he pointed out what could and should be done in the electrical industry. One feature of Mr. Goodwin's talk was his plea for financial support of the public utilities. He said that public utilities could never hope to compete with industrial concerns as regards the return for investment, but that the electrical fraternity should purchase these bonds and urge others to purchase them because of the benefit to everyone of public utility expansion. About $700,000,000 a year are needed for public utility expansion in order to take care of the ordinary needs for electrification.

IOWA CENTRAL-STATION MEN DISCUSS FARM LINES AND RATES.

Large Attendance Marks Nineteenth Annual Convention of State N. E. L. A. Section at Colfax, June 23-25.

Discussion of rate problems and of the final report of the farm line committee were the outstanding features of the nineteenth annual convention of the Iowa section of the National Electric Light Association, held at Colfax, Ia., June 23-25. In addition, the delegates took up questions of customer ownership and of the education of the public to public utility needs. M. H. Aylesworth, executive manager of the N. E. L. A., was the principal speaker at the banquet Thursday night, June 24, making the trip from New York especially to address the Iowa men on "The Future of the Public Utility."

The farm line committee report, submitted by John M. Drabelle, electrical engineer of the Iowa Railway & Light Co., Cedar Rapids, covered all angles of the subject, which is one of interest to Iowa electric utilities owing to the fact that practically all of the farmers in the state are insistent in their demands for electric service.

Urge Adoption of Standard Uniform Policy for Farm Lines.

The committee urged that a standard uniform policy be followed in the adoption of specifications for line construction and that the specifications be submitted to the Board of Railroad Commissioners and in this way provide minimum requirements for farm line construction in the state. The committee also urged that a contract form be adopted, copies of appropriate contracts being made part of the committee report, and that a more uniform policy in regard to rates be followed.

Almost three hours of discussion followed the reading of the report, which ended with Mr. Drabelle saying that "the most serious trouble is lack of uniform practice." The discussion was opened by A. B. Campbell, electrical engineer of the Iowa Railroad Commission, who introduced a wide subject when he asked, "What is the farmer load? What is its character? We all have a suspicion, but not one of us knows just what it really is." In the early part of the discussion it developed that the usual plan in Iowa is for the farmers to build the lines and turn them over to the utilities company for operation. In this connection C. N. Chubb, Davenport, said: "Our company requires the farmers to build the line and we sell them energy after the farmers turn the line over to us. We have discovered that we have no trouble in getting the farmers to build the lines, but the trouble comes after they have been on our lines for two or three months. The farmer does not understand transformer troubles and losses, and blames the company. The farm-line rates are higher than the city rates."

C. M. Morgan, Humboldt, said the practice of

his company was for the farmer to build the line, the company meeting him at the town line with the energy service. The company uses a 3-kw. transformer at a $5 monthly minimum rate. The loss, he said, is a little larger than on a 1-kw. transformer, but the additional service given the farmer allows him to use many appliances, and most of the customers exceed the $5 a month minimum.

N. T. Wilcox, sales manager of the Mississippi River Power Co., Keokuk, said his company was not building farm lines but that service was furnished from those lines already built. "The mistake has been," said Mr. Wilcox, "that the public utility companies are not selling kilowatt-hours, but are selling service. The cost is greater than we realize. Utility companies should charge a heavy minimum rate and then charge a low kilowatt-hour rate. By doing that service will be insured."

F. A. Beatty, Des Moines, said the companies had been forced into giving the farmers service and that one thing required was that more attention be paid to the building of lines from an engineering standpoint. Lines not properly built, contended Mr. Beatty, cost the companies too much for maintenance after being turned over by the farmer. A. W. Jones, Peterson (Ia.) Power & Milling Co., said the farm-line business had crept in on the electrical industry and that the best the companies could do now was to try to avoid mistakes. Mr. Jones said his company was charging $50 a year minimum for a 3-kw. transformer and $60 minimum for a 5-kw. transformer. "We base this rate on the fact," said Mr. Jones, "that if the consumer finds he is not using his minimum of $50 worth of service he will buy appliances enough to use up his full service, and in most cases this results in his using far more than the minimum amount. We have 300 farmer customers and have never built a mile of farm lines. Our company believes it to be to the advantage of the central-station company to own the trunk lines supplying the farm lines, as this does away with any chance of competition."

Others who took part in the three-hour discussion were C. S. Macy, Adel; Paul P. Myers, Grinnell; C. G. Johnson, Chicago; E. L. Fischer, Muscatine; D. K. Lewis, Boone; M. L. Goodman, Britt, and Prof. Arthur Fort, Iowa State University.

In a paper on "Valuation and Rate of Return," B. J. Denman, vice-president of the United Light & Railway Co., Davenport, made a well-considered analysis of the present situation, following his statement that it was imperative that the central-station industry adopt a uniform method of valuation. In his paper Mr. Denman said in part:

Central-Station Companies Should Adopt Uniform Method of Valuation.

"In states having commissions, due to the rulings of the commissions, a certain uniformity of valuation methods naturally follows after the commission has been in office a few years, but even in such states public utilities have found that substantial differences persist even after years under commission regulation. Therefore the adoption of substantially uniform valuation methods by companies themselves is absolutely necessary if the value of the properties is to be protected, and in some states permanent joint committees on valuation and rate of return have been formed. If this is necessary in states with commission regulation, it is much more necessary in states where the regulation rests with the separate municipalities, as it does in Iowa.

"In valuations the most serious difficulty arises from lack of uniformity in regard to the elements entering into the valuation, but the lack of precise use of the terminology of the valuation is nearly as serious. The frequent use of the terms 'price' and 'value' as being synonymous is a case in point. How can the calling of the 'depreciated original cost' of a public utility property the 'present value' be justified, especially when this frequently omits such acknowledged items as 'going concern value'?

"The purchasing power of the dollar must be taken into account in arriving at correct valuations, as the utilities have no occult power to make the 1920 dollar go as far as the 1914 dollar, and this fundamental economic fact must not be disregarded."

Mr. Denman's paper was replete with court decisions from various states tending to show that "reproduction cost new" must be given substantial weight in arriving at valuations. In discussing the report Prof. J. B. Hill, of Iowa State University, said that money invested in public utility companies by the public is supposed to be a less hazardous risk than money invested in

Members of the Iowa Section of the National Electric Light Association Who Attended the

other enterprises, as the utility companies are under the control of regulatory bodies.

C. G. Johnson, chief engineer of the Union Utilities Co., Chicago, operating in several Iowa sections, cited the fact that it was necessary for utility company executives to figure far in advance on rate propositions, because, due to the delays of the courts, it was always months, and frequently years, before a decision was rendered in important cases. In the meantime the utility is forced to accept whatever rate is allowed it by the commission under whose control it is. "This works a hardship," said Mr. Johnson, "for today we are forced to pay employes not what we think they are worth but what they think they are worth, and rate-making bodies are slow to recognize this fact just as they are the fact that as far as utilities are concerned the financial market is a lenders' and not a borrowers' market. The governing bodies in rate cases have been guessing, and in most cases they have guessed wrong. It is high time that utility companies take a rate case involving all principles to court and rush it through to a decision by the highest court so that the amount of rate increase absolutely needed can be determined. An increase of 50 to 75% is needed and must be obtained."

Further discussion on the paper was furnished by M. G. Linn, Des Moines; W. J. Bertke, Sioux City; Sutherland Dows, Cedar Rapids; J. N. Canavan, Chicago, who presented a written discussion, and N. T. Wilcox, Keokuk.

Standardize Methods of Determining Rates for Electric Service.

A paper along somewhat similar lines was "The Determination of Electric Service Rates," by W. J. Green, rate engineer of Cedar Rapids, who was the first president of the Iowa Section at its organization 19 years ago. "Uniform rates throughout the country, except in the districts where the same costs and conditions prevail, are not wanted and should not exist," said Mr. Green, "but a uniform method of determining and promulgating rates is badly needed and the adoption of standard methods of computing rates will result in greater economic benefit to producers, consumers and the public. The public would receive a benefit by the savings in taxes due to the reduction in the work of the commissions and courts by having fewer rate cases. Before one can use a set of rules to determine a rate, power-plant valuation and operating expenses must be accurately allocated so that unit demand and energy costs will be known. This is not a simple matter and requires a carefully prepared set of rules for guide."

Appeal Made for Relief in Connection With Coal Situation.

The seriousness of the coal situation cropped up all through the three days of the convention, President O. H. Simonds, Dubuque, touching upon it in his opening address when he said that the coal situation was the most serious the country has ever known and that information at hand was to the effect that the mines were only receiving 26% of their needed supply of coal cars. The shortage is caused more by the railroad situation and lack of cars than any failure of the mines to produce the coal, declared Mr. Simonds.

Inquiry among the central-station operators present at the convention, numbering about 150, developed the fact that none of them had been able to store any coal so far this summer and that most of them were using up supplies almost as fast as they reached their plants. As a result of the various discussions on the coal situation a resolution was adopted and a telegram formulated that was sent to the Interstate Commerce Commission in Washington urging that immediate steps be taken to furnish a proper supply of cars to the coal mines in Illinois, Iowa and other parts of the country.

F. W. Loomis, representing the Society for Electrical Development, told the convention of the work of the society and urged the fullest co-operation between the section and the society.

Sale of Securities to Customers Considered Good Policy for Utilities.

In discussing "Customer Ownership of Public Utility Securities," E. V. Graham, manager of the s tock and bond department of the Middle West Utilities Co., Chicago, said: "The demand for service is greatest at the time it is hardest to get money. Utility companies today find the cheapest thing they have is their securities. Our company has also found that the sale of securities to employes of the company gives them a new viewpoint of the companies' activities."

Mr. Graham favored a continuous campaign

Nineteenth Annual Convention of the Organization, Held at the Colfax Hotel, Colfax, Ia., June 23-25.

for the sale of securities to customers rather than a periodic, intensive campaign, saying it was not difficult to organize a short, whirlwind campaign, but that it was found that such a campaign interferes with the work of the company and also interferes with the steady selling effort.

In discussing the paper, Mr. Dows said his company, the Iowa Railway & Light Co., Cedar Rapids, had been following the plan of selling to its customers since 1905, and that when the scheme was first proposed it was ridiculed and the company was told it would get no money by that method. It developed into a success, however, and from 70 to 75% of the money raised during the past two or three years by the company has been through the sale of preferred stock to its customers. In March the company sold stock to 65 customers, all of whom were in the laboring class. Mr. Dows considered this a big point, as it enabled the company through customer ownership to get the labor element interested in its property and was good insurance against labor troubles.

M. H. Aylesworth Speaks of the Future of Public Utilities.

At the banquet held at the Colfax Hotel Tuesday night, E. G. Williams, secretary of the Colfax Commercial Club, welcomed the electrical men to the city in a happy vein, after which Mr. Aylesworth, who made the trip direct from New York City to be present, spoke on the future of the public utilities, starting his talk with a reference to the seriousness of the coal situation and telling the delegates that from Colfax he was going direct to Washington to appear before the Interstate Commerce Commission and urge that steps be taken to arrange that priority in shipping rights be given public utility coal.

The coal situation was the most serious now confronting the electrical industry, declared Mr. Aylesworth, and comes at a time when the industry is facing the greatest power demand in its history. One great need, he said, was more and better education of the public as to the needs of public utilities, and he urged the Iowa Section to establish a state committee on public utility information, which will probably be done.

At the final session of the convention on Friday officers for the ensuing year were elected as follows: Frank J. Hanlon, Mason City, president; C. N. Chubb, Davenport, first vice-president; Sutherland C. Dows, Cedar Rapids, second vice-president; M. G. Linn, Des Moines, secretary and treasurer; Rex H. Fowler, Des Moines, assistant secretary. The executive committee will consist of the following members: O. H. Simonds, Dubuque; David Daly, Keokuk; F. H. Brooks, Omaha; Daniel G. Fisher, Davenport; Clarence S. Macy, Adel; A. W. Jones, Peterson; John M. Drabelle, Cedar Rapids; Austin Burt, Waterloo; Don Stevens, Humboldt; Paul P. Myers, Grinnell, and H. Bellamy, Knoxville.

The convention was the most successful ever held by the Iowa Section, seven hours each on Wednesday and Thursday being devoted to sessions and the convention closing with a two-hour business session on Friday morning. Much of the success of the convention was due to the work of Rex H. Fowler, assistant secretary, who had furnished in advance copies of the principal papers to enough of the members to insure full and complete discussions on the different subjects.

DAVIDSON WILL DEVOTE TIME TO COMMITTEE WORK.

Chairman of New Personal Relations Section of N. E. L. A. to Travel Extensively in Connection With Organization's Activities.

That the work of the Public Relations Section of the National Electric Light Association is to be widespread and of great use to the entire electrical industry is evidenced by the fact that James E. Davidson, chairman of the section, has so arranged his business affairs that he will be able to devote at least one-half his time to the work of the section.

Mr. Davidson is vice-president and general manager of the Nebraska Power Co., Omaha, Neb., and on his return from the Pasadena convention, where the section was organized, he made arrangements with his company whereby he could devote all the time necessary to the successful carrying out of the work planned by the section. While the plans of the section have not been fully outlined as yet, it is expected that its activities will keep Mr. Davidson busy at least five or six months out of the next year.

The Public Relations Section is a new one within the N. E. L. A. organization and it will carry on the vitally important and interesting work of establishing and maintaining cordial relations between the public and the central-station industry. Much of the future growth of the electrical industry will depend upon the winning of and the maintenance of the confidence of the investing and electric-energy using public, which is the task assigned to the committee.

While the work will be directed nationally by the section headed by Mr. Davidson, because of the large number of national questions of a public nature with which the association as a whole must deal, the actual public relations work necessarily must depend to a large extent upon the co-operation of the individual member companies.

Besides Mr. Davidson the other members of the section organization are M. S. Sloan, president of the Brooklyn Edison Co., Inc., vice-chairman, and the following as members-at-large of the executive committee: H. C. Blackwell, vice-president of the Kansas City Power & Light Co.; A. C. Marshall, vice-president of the Detroit Edison Co., and W. H. McGrath, vice-president of the Puget Sound Light & Power Co., Seattle, Wash.

MISSOURI UTILITIES ASSOCIATION NAMES COMMITTEE.

President L. P. Andrews, of the Missouri Association of Public Utilities, has appointed the following men as members of the power and light branch of the association: Hugo Wurdach, Light & Development Co., St. Louis, chairman; H. C. Blackwell, Kansas City Power & Light Co.; B. C. Adams, St. Joseph Railway, Light, Heat & Power Co., and F. P. Porter, California (Mo.) Electric Light Co.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

PUBLIC UTILITIES ARE VITAL TO MODERN CIVILIZATION.

Losses Would Be Enormous, Points Out Writer, if People Were Compelled to Live as They Did Prior to the Civil War.

"The time losses, comfort losses, business losses, convenience and health losses and crime increases would be enormous if the public utilities were withdrawn," writes W. H. Hodge, of H. M. Byllesby & Co., in an article recently published in an eastern financial paper.

"How many cases of sickness and death have been prevented because a person made a telephone call instead of venturing forth in inclement weather? How many fires and casualties has electricity saved in households? How many holdups and murders are prevented by good street lighting?

"If our great cities were suddenly deprived of electric railways, telephones and gas service, nothing short of a devastating war or the extermination of the steam railroads could equal the dislocation in the lives and habits of citizens.

"There would be a destruction of real estate values without parallel, a shortage of available labor exceeding anything dreamed of today, and at the same time a sharp reduction in the earning power of skilled labor; hundreds of thousands of vacant dwellings and hundreds of thousands of families living in hastily constructed and unsuitable dwellings; skyscrapers untenanted, great retail houses forced to suspend, the clientage of professional men dispersed and lost, newspapers forced to reduce their size and quality on account of reduced advertising patronage, banks compelled to split up into smaller units, the prices of coal, gasoline, kerosene and fuel oil multiplied.

"In brief, people—and their number is vastly greater now than then—would be compelled to live as they did prior to the Civil War, and before they could conform to such circumstances indescribable misery, poverty, suffering and death would set the American nation back a century."

EDISON CLUB, CHICAGO, TO HAVE ALL-DAY OUTING.

Saturday, July 10, will be a holiday for the employes of the Commonwealth Edison Co., Chicago, at least for every employe who can possibly be spared from his duties, as that date is the one set for the big all-day outing of the Edison Club, composed of employes of the company, at Riverview Park. To allow the club to properly celebrate the occasion, President Samuel Insull has declared the day a holiday.

Chairman A. B. Gates, of the field day committee, has arranged a long program consisting of all sorts of popular athletic events, professional circus and vaudeville acts, band concerts and dancing. The attendance at the picnic and outing will not be confined to members of the Edison Club, as all employes of the company, whether members or not, have been furnished with tickets for the occasion for themselves and families.

S. E. D. ISSUES NEW SERIES OF HELPFUL ADVERTISEMENTS.

The Society for Electrical Development has prepared a new set of advertising copy for use of central-station companies and contractor-dealers, much of which has to do with the use

Entertain your Work on the Porch

—Assisted by your Electrical Servants

Don't get overheated before you run into town, take your ELECTRICAL servants out on the porch and iron your white waists and skirts in comfort, and keep your engagement for lunch feeling cool and refreshed—

Ironing in the fresh air used to be absolutely out of the question because the old sad-iron hated any kind of a breeze.

BUT NOW—there is nothing to stop you working in comfort if you use the ELECTRICAL WAY.

The recipe is—

Get an ELECTRIC FAN and an ELECTRIC IRON, add things to be ironed, turn on the switches and settle yourself to a really enjoyable morning's work.

Our Service Means—
Full Information
Courtesy
Prompt Deliveries
Satisfaction

(Your Name and Address)

Development as Aid to Central-Station Companies and Contractor-Dealers.

that can be made of electrical appliances during the summer months. The advertisements are all designed with catchy slogans such as "entertain your work on the porch," illustrated herewith.

Beside the advertisements for appliances the society also has made up advertising copy that can be used by central-station companies in new business, wiring and lighting fixture campaigns.

DECLINE IN BOND PRICES AFFECTS UTILITY EXTENSIONS.

Western Writer Points Out Some Interesting Facts in Connection with Living Price Increases and Sale of Representative Bonds.

Since Jan. 1, 1913, the average price of 326 commodities, as charted by the United States Bureau of Labor, has increased 153%, says a writer in the June issue of the *Pacific Power & Light Co. Bulletin*. Continuing, he explains that this percentage of increase roughly indicates the increase in the cost of doing business. Since January 1, 1913, the average price of 40 representative bonds issued by railroads, industrials and public utilities listed on the New York Stock Exchange has declined from 92 to 66.7, or 28%. This decline reflects the increase to corporations in the cost of obtaining money for extensions to plants and for refunding maturing obligations. The great advance in the cost of practically everything, including money, has, of course, brought about the decline in the price of bonds. Public utilities, like industrials, have experienced big advances in the cost of operation, maintenance and construction. However, public utilities have been prevented from increasing at will their rates to cover the increased cost of service because their rates have depended upon the judgment of regulatory commissions. The inability to adjust rates to meet increasing costs have placed public utilities in an unfavorable position to compete with industrials for money for extensions, new developments and to refund maturing obligations. Public utilities cannot grow and prosper unless their credit is maintained, and this cannot be done unless their earnings are adjusted to meet changed conditions; and an improperly nourished public utility hinders the progress and prosperity of its community. There is only one way out of the present untenable situation, and that is through increased rates.

ELECTRIC SERVICE FROM RURAL TRANSMISSION LINES.

Iowa Engineer Discusses Best Methods of Getting Satisfactory Results From Selling of Energy in Farming Communities.

In an official bulletin issued by the engineering extension department of Iowa State College, A. B. Campbell, formerly of the staff of the college but now electrical engineer for the Iowa State Railroad Commission, gives some timely hints to central-station companies and contractor-dealers who are seeking to interest farmers in the possibilities of electrical service on the farm. The bulletin was prepared for distribution among farmers and in its preparation technical discussion was avoided.

Taking up the application of electricity to the farm, Mr. Campbell points out that there are many ways in which electricity may be used to advantage on the modern farm, and it should be realized at the start that most of these applications must be made, if the service is to be had at a reasonable cost. It will doubtless require considerable time before the farmer can arrange to utilize electric power to its greatest advantage, but as soon as the convenience of electric drive is realized, it will only be a question of time until practically all of the small and medium-sized stationary farm machinery will be driven by electric motors.

With rural electric development in its present stage, it appears that farm machinery requiring motors larger than 5-hp. capacity can be more satisfactorily driven by tractors. There are several problems of an engineering nature which enter into the use of large motors on farms, and until rural service becomes more standardized farmers should not be too hasty in arranging to drive such machinery as threshing machines and feed-grinders with electric motors.

In addition to the convenience, comfort and labor-saving features of electricity on the farm, another very important reason why electricity should be used extensively on those farms where it is available is that it will help to solve some of the problems which confront the central-station operators in offering this class of service. If sufficient amount of energy can be used to keep the individual transformers from operating on extremely light loads for several hours each day, it will improve the conditions under which the central-station generating equipment must operate. This should not be taken to mean that electric power should be used when it is not necessary, merely to improve operating conditions, but the point is that if electricity from a central-station or transmission line is going to be used at all, arrangements should be made to utilize it with profit as uniformly as possible throughout the working hours of the day.

A fundamental rule governing the distribution of electrical energy that should be explained to the farmer is that electrical energy can be transmitted with smaller loss at a high voltage than at a low voltage, other conditions being the same. It is not permissible to carry this high voltage into a residence or about the farm on account of the hazards which it presents to life and property. Consequently, the electrical energy is transmitted from a central or substation at a high voltage and then changed to a low voltage by means of a transformer located at or near the farmer's premises.

SINGLE INSPECTION IS SUFFICIENT, RULES MARYLAND BOARD.

In a case brought before the Maryland Public Service Commission covering inspection of house-wiring, the commission has handed down a decision that a single inspection of wired houses in the city of Baltimore is sufficient. By this decision the additional inspection heretofore conducted under the direction of the Board of Underwriters will be abandoned.

OPERATING PRACTICE

Methods and Problems Embracing Operation and Installation of Power-Plant Equipment and the Distribution of Electrical Energy

POLE LINE IS RESTORED QUICKLY AFTER TORNADO.

The Greenville (O.) Electric Light & Power Co. reports a remarkable feat of construction done by that company in the path of the tornado which swept across Drake county, O., March 28. This tornado traversed about 16 mi. diagonally across the county, fortunately striking no towns, but destroying all farm buildings in its path.

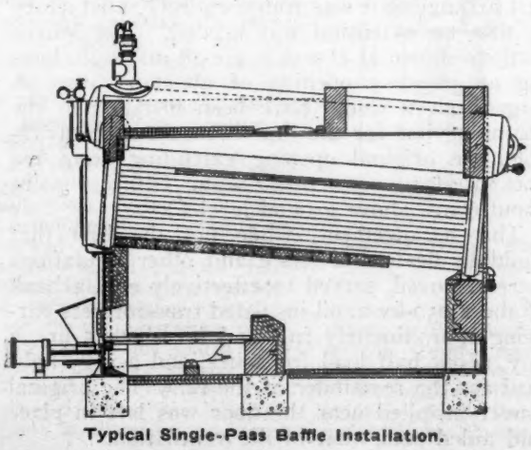
The path of the tornado crossed the high-tension line serving Union City from the Greenville station. This line consists of 33,000-volt, three-phase construction with 3-phase, 2300-volt lines, supplying a small town just north of the tornado's track, carried below the high-tension wires. The storm tore up a half mile of this line, taking down ten poles with everything on them, and the wires, crossarms and insulators from ten more. The interurban and telephone lines were parallel to the power lines so that all three systems were twisted into an almost unrecognizable mass of wires, poles, insulators and debris.

The tornado occurred about 7:30 p. m. and at 4:00 a. m. the poles had been reset and by 10:30 a. m. the current was passing over the line the same as if the tornado had not occurred. This was considered a remarkable feat of construction and restoration of service after such wreckage.

PROPER BAFFLING OF BOILERS AN IMPORTANT ITEM.

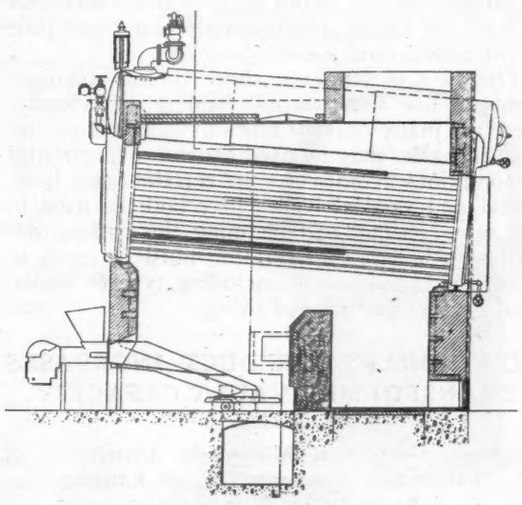
Variation in Baffle Arrangement Makes a Corresponding Change in the Over-All Efficiency of Boiler and Furnace.

A series of tests made some time ago illustrates the importance of giving proper attention to the arrangement of baffles in a boiler for a given set of working conditions. These tests were carried on in the plant of a large central-station company located in the Middle West and were primarily designed to determine the characteristics of different baffle arrangements on a given type of boiler.



Typical Single-Pass Baffle Installation.

These tests were made on a Heine boiler which, for the purpose of the tests, was baffled in three different ways, first, with a single pass; second, with a double pass, and, third, with a triple pass. This boiler was 17 tubes high, and



Boiler Arranged With Double-Pass Baffle.

for the double-pass boiler arrangement a baffle was installed on the tenth row of tubes, in addition to the regular baffles on the first and last rows, as used in the single-pass layout. For the three-pass boiler baffles were laid on the eighth and fourteenth rows of tubes in addition to the regular baffles on the top and bottom rows. The test results indicated efficiencies of 57, 62 and 67% for the single, double and triple-pass arrangements.

However, it is not always possible to make a great variety of baffle rearrangements even if such rearrangements might be advantageous in certain conditions. In a shallow, horizontal water-tube boiler the installation of an extra baffle might so restrict the draft over the fire as to defeat the object of the change, and result in a material decreasing of capacity of the entire installation.

At the Bureau of Mines a horizontal return tubular boiler of the ordinary single-pass type was changed to a double-pass boiler by putting the breeching connection on the rear end and allowing the hot gases to enter only through the tubes in the lower half of the shell. The efficiency in this case was increased about 5%.

However, this change is not to be recommended without qualification, as there is a possibility, unless special provision is made, of the gases short-circuiting from the furnace directly to the breeching connection.

Of course, there is a limit to the practical length of the gas travel, as to cool the gases down to the boiler-water temperature would require a very large amount of heating surface. Also, the gas travel might be so long that the passages would be restricted and the gas velocity exceedingly high, causing excessive draft loss. Up to a velocity of about 35 ft. per sec. in small flues the friction loss is not excessive, but beyond this velocity the friction loss increases rapidly. The friction loss in a flue increases as the square of the velocity of the gas; in other words, the draft loss through the boiler varies as the square of the boiler hp. developed, since the gas volume varies almost directly with the hp. generated. Then, if the friction loss through a boiler at 100% of rating is 0.12 in. at 200% of rating, the loss would be four times this, and at 300% of rating approximately nine times 0.12 in., or 1.08 ins. of water.

The two illustrations show typical arrangements of one and two-pass baffling. Obviously, there are many possible types of baffle plans, and vertical baffles may be used instead of horizontal if conditions require it. In certain cases horizontal and vertical baffles may both be used in the same setting. In planning the baffling design of a boiler, consideration must be given to all the factors involved including type of boiler, kind of fuel and rate of firing.

DOWN-DRAFT AIR DUCT INCREASES TRANSFORMER VAULT CAPACITY.

Improved Ventilation Allows the Installation of Larger-Size Equipment in an Existing Room Below Ground Level.

On account of a large increase in the connected load of a certain industrial plant it became necessary to make a rather large increase in the size of the transformers supplying service from the central-station circuit. The transformers were located in an isolated vault in the basement of the plant, the vault being ventilated by means of two sets of louvers, allowing air to enter the vault from the basement floor and pass outdoors near the roof of the vault. After the larger transformers were installed and the increased load connected up it was found that the vault temperature was quite high and that the transformer temperatures were too high for safety. To protect its interests, the central-station company, which owned all the equipment in the vault, ordered the plant owner to build on some other part of the property a larger vault or provide a cooler location for the transformers. There was no room available to increase the size of the vault and there was no other location better suited to the purpose.

Mechanical ventilation of the vault was proposed, but the central-station company ruled it out because of the great chances of its being neglected to the detriment of the transformers. After considering several plans, the scheme shown in the accompanying illustration was adopted as a trial solution of the ventilating problem. The ventilating louvers shown at *D* extended across the entire end of the vault, a distance of 12 ft. One louver section, 2 ft. long, shown at *E* was connected to a sheet-metal tube, 2 ft. by 1 ft. in cross-section, which extended down to a point about 18 ins. above the vault floor. This arrangement was found to work quite well, keeping the transformer temperature down below the values called unsafe by the central-station engineers.

Air circulated through the tube in the direction shown by the arrows *B*, the cooler outside air coming down the tube, spreading over the floor, and forcing out the heated air through the

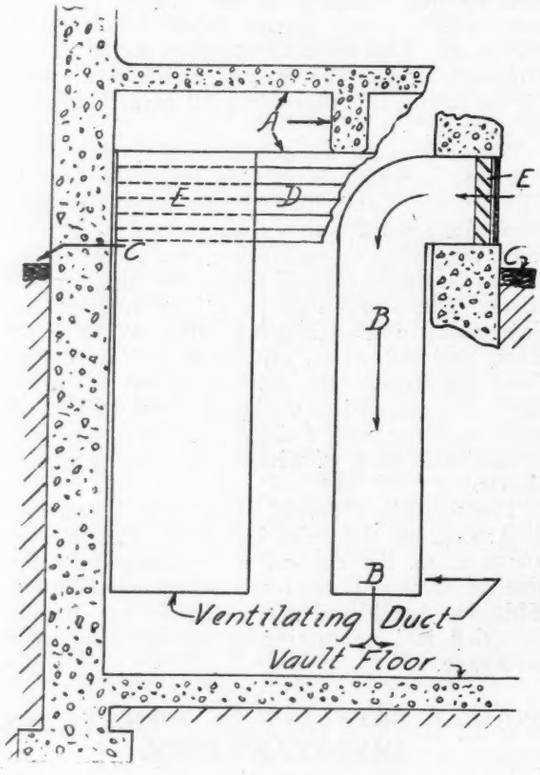


Diagram of a Ventilating Scheme Used to Cool a Transformer Vault Below Ground Level.

10-ft. section of louver remaining open near the ceiling. It had been planned to extend the lower end of the tube to the far side of the room if required to secure proper circulation, but the first arrangement was found entirely satisfactory so that no extension was needed. The louver sections shown at *D* and *E* are 18 ins. high, having an effective opening of about 15 ins. A larger louver would have been installed in the beginning but for the limitations in space available, the original opening extending from the bottom of the structural beams *A* to a point about 6 ins. above ground level *C*.

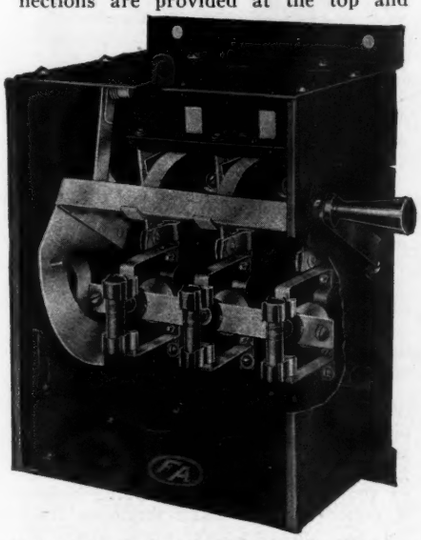
This arrangement, while not the best that could be devised if space and other limitations were removed, served to effectively cool a bank of three 250-kv-a. oil-insulated transformers carrying approximately full load for about 5 hrs. a day, about half load for 5 hrs. and a very light load for the remainder of the time The original louver installed near the floor was left in place and aided somewhat in the ventilation.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Squirrel-Cage Motor Switch for Starting Service.

A motor-starting switch with fused running and nonfused starting positions is shown in the accompanying illustration. This device, which is manufactured by the Frank Adam Electric Co., St. Louis, Mo., is suitable for starting motors of 5 hp. or less, although the switch itself is sufficiently proportioned to handle motors as large as 15-hp. in capacity at 440 volts, according to the manufacturer's statement. The switch is entirely inclosed within a sheet-iron casing which is arranged for wall mounting. Knockouts for conduit connections are provided at the top and



Inclosed Switch for Starting Small Induction Motors.

bottom of the switch, and the casing is fitted with a sliding door.

When starting the motor the operating handle, which is located on the right-hand side of the switch, is moved forward to a point marked "start." It should be held in this position until the motor speeds up, after which it may be released and will automatically return half-way back between the "off" and "start" positions to a point marked "run" on the switch. In order to stop the motor, the handle is simply pushed downward from the "run" position to the "off" position.

During the starting period the fuses are short-circuited, thus preventing their blowing out during this time. When the switch handle is moved to the position marked "run," the short-circuiting bar is released and the fuses become active. When moving the handle to the "start" position from the "off" position, the short-circuiting mechanism operates before the switch itself makes contact, and when moved from the "start" position to the "run" position, the short-circuiting bar is simply released. There is, therefore, no arc on the short-circuiting mechanism of the switch and the circuit is not broken in going from the starting to the running connection.

The inclosing case and mechanism are so arranged that the case cannot be opened while the switch is in the open position, and the switch cannot be closed with the cover open.

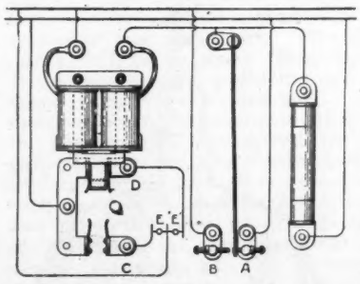
Porcelain Current Tap.

A current tap, known as Catalog No. 78, has recently been put on the market by the Bryant Electric Co., Bridgeport, Conn. This tap is intended for use in connection with the sockets and bases of the interchangeable porcelain outlets made by this company. It is made of glazed-finish porcelain and is designed for insertion between the porcelain base and regular socket. By the use of this tap, an extra extension-cord outlet is provided for the convenience of a cord-connected device. The tap part is of standard type for use with any standard parallel-blade plug.

Relay for Control of Electric Circuits and Devices.

Heaters, valves and many other devices are often controlled by contact-making arms regulated by thermostats, gauges, meters, etc. Obviously, the reliability of control depends upon clean contacts free from the effects of sparking, burning or other corrosion. The Palmer Electric & Manufacturing Co., Boston, Mass., has developed a control system in which the contact-making points do not open the circuit, thus avoiding, it is claimed, the damaging results of burned contacts.

A diagram of the new system is shown in the accompanying illustration. The main features of the system are a set of contact points, a resistance tube in series with a magnet and a set of contacts made or broken by the



Control Relay With Closed-Circuit Arrangement.

movement of the magnet armature. As shown in the illustration, the contact-making points may be actuated to short-circuit either the resistance tube or the magnet coils. When the contact at *A* is closed, the magnet draws up its armature, closing the main device-circuit at *D*. This circuit remains closed until the contact point at *B* is closed, short-circuiting the magnet and thus allowing the armature to fall and closing the other main device-circuit at *C*.

This arrangement makes it possible to have simply an on and off control, a high and low control or a reversing control as desired. In case the on and off control is desired, only one of the main contacts, *C* or *D*, is used.

Small-Size Electric Blasting Device.

There are several practical reasons why blasting charges should be fired by the electric method, any one of which more than justifies its use. The

Blasting Device Suitable for Five or Less Simultaneous Shots.

blaster is at a safe distance from the shot when he fires it, he can time the blast to the second, no time is lost waiting for fuse to burn, and hang-fires and miss-fires are eliminated.

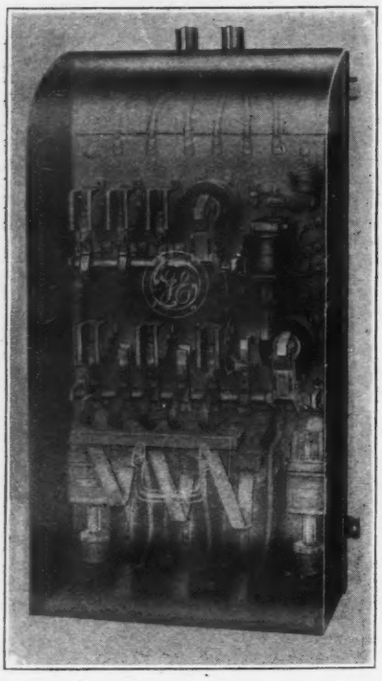
For blasting in wet work the electric method is more reliable than other methods because moisture does not penetrate an electric blasting cap nearly so quickly as it does a blasting cap crimped to fuse.

By firing several shots simultaneously a greater amount of work is done by the explosive, one charge helps the other, and less explosives are required than when the charges are fired singly by cap and fuse.

An electric blasting device, known as the Davis No. 1 blaster, is being marketed by the Atlas Powder Co., Philadelphia, Pa. This blaster is powerful for its size, developing ample current to fire five 30-ft. copper-wire electric blasting caps or five 6-ft. iron-wire electric blasting caps, connected in single series. It is particularly suited for coal-mine work and for all operations where not more than five shots are fired together. It is well adapted for agricultural blasting.

Automatic Starter for Induction-Motor Service.

A complete automatic starting and overload switch is shown in the accompanying illustration. This switch, which is manufactured by the General Electric Co., Schenectady, N. Y., is recommended by the manufacturer for service in



Automatic Induction-Motor Starting and Control Switch.

connection with squirrel-cage induction motors driving line shafts, pumps, compressors and other loads of a similar character, and is designed for push-button, float or pressure-governor control.

The starter consists of one five-pole contactor for starting, one three-pole contactor for running, a current-limit relay for controlling these contactors, two inverse-time-element overload relays and a set of compensator coils. All this apparatus is mounted on a panel and inclosed in a case which is provided with facilities for locking it shut when desired. It may be constructed so that it can be mounted either on the wall or on a pipe framework. The compensator proper is designed to be hung from a conduit box which is separable so as to facilitate wiring.

Closing of the master switch starts the operation of the switch proper by causing the five-pole contactor to close, thus connecting the compensator to the line and to the motor terminals. The accelerating relay, at a predetermined current value, opens the starting circuit and closes the circuit of the three-pole running contactor coil.

An interlock on the starting contactor completes the circuit to the line-contactor coil, when the former opens, thus preventing the closing of the running contactor before the starting contactor has opened. The starting contactor is further provided with a normally open interlock which makes it unnecessary to hold in the starting button or other device during the starting period.

The contactors used have solid-copper contact tips that are easily renewable, and are provided with magnetic blow-outs and moisture-proof coils. They are of a type that experience in hard service has proved will stand up well under the most exacting and severe conditions. The compensator winding has two coils for two-phase motors and three coils for three-phase motors, which insures balanced starting currents and maximum starting torque per ampere of line current. The taps terminate in an accessible place in front of the compensator coils, so that the set most suitable for any particular application may be readily selected.

By means of this starter the automatic starting of the motor is properly provided for independent of the operator's judgment. This is accomplished through the accelerating relays or current-limit relays which operate the contactors so as to disconnect the auto-transformer and connect the motor on the line on proper acceleration. Overload protection is furnished by two inverse-time-element relays which are operative at all times.

Suspension Lighting Unit With Steel Reflector.

A suspension lighting unit for use in offices or stores has been brought out by Bayley & Sons, Inc., Brooklyn, N.Y. This fixture is provided with a 30-in. flat, white-enameled reflector and a 20-in. bowl. Lamps of from 100 to 500-watt capacity may be used in this unit.

Outlet-Box Cover With Swivel Fixture Opening.

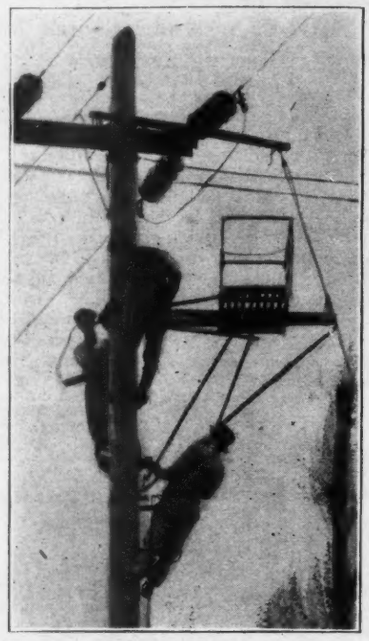
In the hanging of lighting fixtures, suspended on pipe stems, considerable time is often required in fitting the box cover so that the lamp fixture hangs true and straight. This difficulty is somewhat increased in case the outlet box is installed in an irregular position. To overcome this difficulty, the Appleton Electric Co., Chicago, has designed a swivel cover for use with either 4-in. round or octagonal outlet boxes. This cover is arranged to accommodate a ½-in. conduit fixture-stem and will per-

Industrial Lighting Fixture Suspended From a Swivel-Covered Outlet Box.

mit the fixture to hang in a vertical position even though the box be installed at an angle. One of the many advantages of such a fixture suspension is the fact that the fixture will hang correctly eve nthough the work be disturbed.

Insulating Safety Staging for Line Repair Work.

The advancing methods and practices of power generation and distribution have called for higher voltages, safety and reliability of service. Transmission service requires rugged and often duplicate construction to insure both con-



Safety Staging Being Installed for the Removal of an Insulator.

tinuous service and safe maintenance practices.

A special insulated safety staging, intended for use in the maintenance of high-tension lines, has been perfected and offered to the trade by the Bush Electric Co., Cleveland, O. It is claimed that the use of this staging makes it unnecessary to build duplicate lines for safe maintenance work, since all jobs within reason can be done in safety, from this staging.

The safety staging, made of carefully selected hardwood, submitted to a special drying and impregnating process, has been on the market for some time. It is only recently, however, that this treatment has been perfected to a point where the manufacturers have felt justified in eliminating all insulated tools, such as have been used in the past, and allowing the men to work direct on the live lines with bare hands. With this staging properly placed, as shown in the photograph, the man enters it and, by so doing, interposes between himself and the pole or steel tower an insulating medium capable of withstanding several hundred thousand volts. Guards are so placed as to prevent any possibility of accidental contact with a grounded or other part.

The manufacturers claim that this apparatus as now developed is satisfactory for work at 110,000 volts and that this limit will soon be raised. Favorable footing and easy working positions are other features of this apparatus, and it is stated that the men are much safer working bare handed from this staging than when working with gloves and long-handled tools from a position on the pole itself.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Reliance Lighting Fixture Corp., New York City, has leased property at 271 Canal street, for a new local establishment.

Phillips Electrical Co., Craig street, Montreal, Que., will erect a two-story plant 40 by 60 ft., to cost about $25,000, on Henrie Julien street for the manufacture of electrical specialties.

Cooper Hewitt Electric Co., 95 River street, Hoboken, N. J., has issued a splendidly illustrated portfolio showing installations of Cooper Hewitt lamps in various industrial plants in the United States.

Brammer Manufacturing Co., Davenport, Ia., is sending the trade small folders giving descriptions and illustrations of the several types of washing machines manufactured by the company, including the "Knoxall," "O. K.," "Vacuum," "Water Queen," and the "O. K." one-bench complete laundry.

Laundryette Manufacturing Co., 1190 East 152nd street, Cleveland, O., is building a two-story addition to its plant, covering a site 80 by 140 ft., of brick and reinforced concrete construction. The addition will enable the company to about double its production of "Laun-Dry-Ette" washing machines.

S. K. F. Industries, Inc., New York City, announces the resignation of B G. Prytz as president of the corporation, he having been elected managing director of the parent company with headquarters at Gothenburg, Sweden. F. B. Kirkbride, former vice-president, has been elected president to succeed Mr. Prytz.

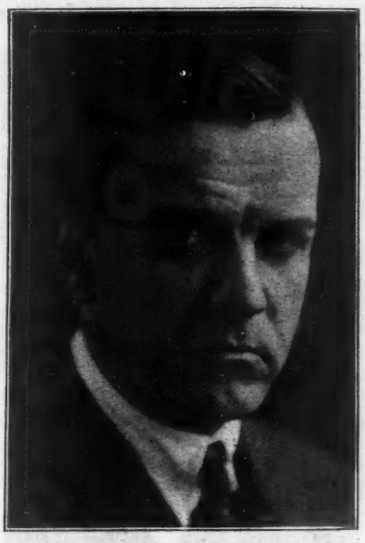
Stephens-Adamson Manufacturing Co., Aurora, Ill., manufacturer of coal-handling equipment and other labor-saving devices, has issued a booklet as an aid in "promoting advanced conveying practice," in which are shown a number of installations made by the company in various parts of the country.

Western Electric Co., Inc., 195 Broadway, New York City, has opened a new supply sub-warehouse at 930 West Rayan street, Youngstown, O. C. A. Strouss is in charge of the sales and H. B. Bergmann in charge of the stores department. The new office reports to the Pittsburgh distributing house.

Economy Fuse & Manufacturing Co., Chicago, announce the appointment of F. L. Easton as district sales manager of its Denver, Col., office. Mr. Easton, who was formerly connected with the Economy company, but who more recently has been doing sales promotion work for the Gates Rubber Co., succeeds R. M. Olsen, who resigned recently. The Denver office is located at 205 Commonwealth building.

Sunnyhome Electric Co., Detroit, Mich., a subsidiary of the General Motors Corp., is building a temporary factory with 12,000 ft. of floor space on Scotten avenue, to manufacture engines and generators for farm lighting and power.

General Electric Co., Schenectady, N, Y., has announced the appointment of E. B. Merriam as director of industrial relations for the Schenectady works to administer and co-ordinate hitherto separate functions dealing with the relations of employer and employees. The plant employs about 22,000 persons. Confidence and good will are considered by the company to be the foundation of successful enterprise, and these are to be fostered by securing a strong point of contact between employer and employees. The main effort will be to make them understand each other's problems and respect each other's opinions. The maintenance of harmonious and helpful relationships throughout the organization of a large enterprise is now considered to rank in importance with production, distribution, finance and other functions of management. Mr. Merriam, the appointee, was formerly manager of the industrial service department. He will have executive charge of employment, education, instruction and training, welfare, Americanization, safety, workmen's compensation, and physical examinations. Mr. Merriam has been with the General Electric Co. for the past 19 years, having been through the student course, construction, testing, designing, engineering and commercial departments before taking up his present work.



E. B. Merriam.

Standard Underground Cable Company, Washington street, Perth Amboy, N. J., manufacturer of insulated wires and cables, has completed plans for the erection of a one-story addition, 40 by 120 ft., to cost about $20,000.

Electric Steel Furnace Construction Co., Finance building, Philadelphia, Pa., has engaged George P. Mills to take charge of the work of developing electrical industrial heating furnaces for the company. Mr. Mills was formerly electrical sales engineer of the General Electric Co. at its Philadelphia office.

Square D Co., Detroit, Mich., and Walkerville, Ont., has issued its new catalog No. 25, showing the following line of safety devices manufactured by the company: safety switches, steel inclosed switches for industrial control, service entrance switches, motor starters, compensator type switches, plug receptacles, iron-clad switches, meter protective trims and a complete list of accessories. An important feature of the catalog is the inclosed cutout box, a new device designed for use in connection with Square D switches.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., in a statement just issued says: "Recent advertisements of the Westinghouse Union Storage Battery Co., Swissvale, Pa., have, unfortunately, led many to assume that the Westinghouse Electric & Manufacturing Co. was entering the storage battery field. In order to clear away any misunderstanding the Westinghouse Electric & Manufacturing Co. authorizes the statement that the Westinghouse Union Battery Co. is owned and controlled by the Westinghouse Air Brake Co., Wilmerding, Pa., and the Westinghouse Electric & Manufacturing Co. is not in any way connected with the manufacture, sale, distribution or service of its product."

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has moved its Chicago offices from the People's Gas building, where it has been located for the past eight years, to the company's own building at 323 North Michigan avenue, on the new Michigan boulevard link. Because of the rapidly growing business in the Chicago territory the 15 rooms in the People's Gas building comprising the Cutler-Hammer offices were outgrown and, with an eye to future expansion, the company took over its new building. This also makes available extra storage space, which makes it possible to carry a large amount of stock of standard apparatus and parts for ready delivery. H. L. Dawson is the manager of the Chicago office, which handles the business of 19 states, with suboffices in Cincinnati and Detroit.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

ALLEN E. GOODHUE has been elected vice-president in charge of sales of the Chicago Pneumatic Tool Co., to succeed the late W. P. Pressinger.

B. G. KOETHER, formerly of Detroit, has been made assistant general manager of the Hyatt division of the General Motor Corp., with headquarters at Harrison, N. J.

H. F. STRICKLAND has resigned as chief engineer of the Hydro-Electric Power Commission of Ontario. Mr. Strickland was connected with the commission for eight years.

CAPT. W. A. STEEL, late chief wireless officer of the Canadian wireless corps in France, has been appointed chief technical officer of the Canadian permanent signal corps with the rank of major.

VAN C. SMITH, formerly connected with Henry L. Doherty & Co., New York City, is now attached to the bond department of H. M. Byllesby & Co., as representative in Oklahoma, Texas and Kansas.

C. D. LAMOREE, manager of the supply division of the Los Angeles (Cal.) district office of the Westinghouse Electric & Manufacturing Co., has resigned to go into business in the newly-formed firm of LaMoree and Clapp, Inc.

W. C. ROTT, formerly with several large steel companies and prominent designing and construction engineers, has joined the staff of Barton R. Shover, consulting electrical, iron and steel plant, and steam engineer, Oliver building, Pittsburgh, Pa.

EDWIN A. ROGERS has resigned his position as power-plant engineer of the New Cornelia Copper Co., Ajo, Ariz., and has opened an office as consulting engineer in San Francisco, Cal., specializing in fuel-oil combustion and power-plant efficiency work.

GEORGE P. SONN, formerly with the National Conduit & Cable Co., Inc., and the National Brass & Copper Tube Co., Inc., as mechanical engineer, is now with the Machine Tool Engineering Co., Inc., Singer building, New York City, as special sales representative.

RALPH H. WILEY has been appointed chief of the electrical department of the city of San Francisco, Cal., succeeding Arthur Kempston, who recently resigned. Mr. Wiley has been assistant chief of the department since 1917. He is succeeded in that position by Gordon C. Osborne.

HOWARD SPRECKELS has been made secretary of the Pitt River Power Co., San Francisco, Cal. The company is soon to start work on a 50,000-kw. hydroelectric development in Northern California. Mr. Spreckels was formerly connected with the accounting department of the Universal Electric and Gas Co., San Francisco.

L. R. ARDOUIN, secretary of the San Francisco (Cal.) Association of Electrical Contractors and Dealers, has resigned and will take up the study of law.

P. R. ROGERS, assistant accountant for the Public Utilities Commission, Washington, D. C., has resigned, to accept a position with the Internal Revenue Bureau.

WARNER JONES has been appointed manager of sales for the Erner Electric Co., Cleveland, O. Mr. Jones has a wide acquaintance in the electrical

Warner Jones.

trade, especially through the Middle West, where his new duties lie. He has been actively connected with the sales work in this field for almost 22 years, having been with the Nungesser Carbon & Battery Co., until that company combined with the National Carbon Co., when Mr. Jones became sales manager of the Dayton Fan & Motor Co., remaining there until he joined the Erner company forces.

EUGENE DOWLING has been made general manager of the steel industry department recently established by the H. W. Johns-Manville Co., New York City.

ROBERT A. BOLE has been appointed vice-president of Manning, Maxwell & Moore, Inc., 119 West 40th street, New York City. Mr. Bole will continue his duties as general sales manager at Pittsburgh for the corporation.

DR. C. O. MAILLOUX, past president of the American Institute of Electrical Engineers and president of the International Electrotechnical Commission, has been made an honorary member of the Societe Francais des Electriciens, the leading electrical society of France.

PROF. C. C. WILLIAMS, of the school of engineering at the University of Kansas, will go to Europe this summer to study transportation problems there. He will visit England, Holland, France, Belgium, Italy and Switzerland.

F. H. FAY, supervisor of printing telegraph service of the American Telephone & Telegraph Co., New York City, has received from the French government the citation of Chevalier du Merite Agricole. During the war Mr. Fay was a major on the staff of Brig.-Gen. Edward Russel, chief signal officer of the American Expeditionary Forces in France.

J. W. DORSEY, assistant professor of electrical engineering at the University of Manitoba, has incorporated a company under the name of the Dorsey Electrical Laboratories, Ltd. Prof. Dorsey announced a few months ago that he had discovered a new and cheaper method of transmitting electrical power, but no details of his invention have yet been made public.

ALEXANDER WILSON has opened an office as consulting engineer in the Yorkshire building, Montreal, Que., having recently resigned as assistant chief electrical engineer of the Montreal Light, Heat & Power Co. Mr. Wilson is a graduate of McGill University, Toronto, Ont., in electrical and mechanical engineering. He is an associate member of the American Institute of Electrical Engineers and the Illuminating Engineers' Society and a member of the Canadian Electrical Association.

G. B. ROSENBLATT, who specializes in the commercial and technical activities of the Westinghouse Electric & Manufacturing Co. in the west with respect to metal mining and smelting, coal mining and oil, and electrometallurgical and electrochemical industries, has moved his headquarters from the Salt Lake City office to the San Francisco office. Mr. Rosenblatt entered the employ of the Westinghouse company in 1902 after graduating from Columbia University. After finishing the engineering course at the works in 1904, Mr. Rosenblatt joined the transformer engineering department and was sent west in 1907. Mr. Rosenblatt's 13 years' experience in the western mining activities have ably qualified him for his present responsibilities.

OBITUARY.

CHARLES H. VINAL, construction manager of the Allis-Chalmers Manufacturing Co., Milwaukee, died suddenly at his summer home, Little Muskego Lake, Wis., June 12, at the age of 61 years.

LOUIS L. BRINSMADE, formerly manager of the Westinghouse Machine Co., and previously for 22 years with the Western Electric Co., died recently at his home in New York City, following a brief illness. At the time of his death he was at the head of his own machinery company.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES

Holyoke, Mass. — The city council has arranged for the construction of coal bunkers and other improvements at the municipal electric power plant.

Easthampton, Mass. — The Hampton Co. will install boilers and auxiliary equipment at its industrial power house for factory service.

Milton, Mass.—The New England Telephone & Telegraph Co., 50 Oliver street, Boston, has had plans prepared for the erection of a new exchange plant at Milton.

New Haven, Conn. — The Munson Factory & Power Co. has filed notice of dissolution under its state charter.

New Haven, Conn.—The directors of the Springside farm will install new electrical equipment at the institution.

Brooklyn, N. Y.—The New York Telephone Co., 15 Dey street, New York City, is having plans prepared for the erection of a two-story, brick exchange plant, 100 by 100 ft., at Coney Island avenue and Avenue R, to cost about $150,000. McKenzie, Voorhees and Gmelin, 1123 Broadway, New York City, are the architects.

Buffalo, N. Y.—The city council has ordered filed an ordinance introduced for the electrification of railway lines entering the city, and will defer any action in this direction for the present.

Long Island City, N. Y. — Plans have been filed by the National Sugar Refining Co., 129 Front street, New York city, for the erection of its power plant on Dock street, near Brent street, to be one-story, 52 by 61 ft., estimated to cost about $28,000.

New York, N. Y.—Electric and mechanical equipment, refrigerating apparatus, etc., will be installed in the ice and refrigerating plant to be erected at 245 West 27th street by the Fur Merchant's Warehouse Corp., 238 West 38th street. The structure will be two, eight and ten stories, and is estimated to cost about $300,000.

New York, N. Y.—The board of estimates has voted to revoke the franchise of the Richmond Light & Railway Co., Staten Island. The action has been caused by the raising of the traction fare to eight cents, by the company, following the appointment of a receiver. The company has 90 days to comply with the conditions of the franchise, according to the ruling of the board.

New York, N. Y. — Transit Construction Commissioner Delaney has submitted an application to the board of estimates for the issuance of $14,734,000 in bonds for rapid transit construction. Of this sum $7,303,000 is required to complete the work required under contract No. 3 with the Interborough Rapid Transit Co., and $475,000 for additional work not as yet contracted for; $6,965,000 represents the city's share in the Brooklyn Rapid Transit section of the dual system.

New York, N. Y.—In addition to its proposed new radio station on Long Island, estimated to cost about $1,000,000, the Radio Corp. of America, Woolworth building, is having plans prepared by the J. G. White Engineering Corp., 43 Exchange place, for a series of similar high-power radio plants to be located in different parts of the world.

North Tonowanda, N. Y.—The Economy Light, Fuel & Power Co. has filed notice of dissolution under its New York state charter.

Stapleton, S. I., N. Y. — Electrical and mechanical equipment will be installed in the laundry to be constructed by the Treasury Department, Washington, D. C., on a local site. Initial plans are now being revised.

Syracuse, N. Y.—The Oswego River Power Transmission Co., Oswego, has been merged with the Seneca River Power Transmission Co., Syracuse.

Troy, N. Y.—Henry Ford, Detroit, Mich., is negotiating for a license to utilize the water power from the dam at Green Island, under the water-power bill recently signed by President Wilson, in connection with his proposed tractor plant in this section. The power will be used for hydro-electric service. The mechanical works will comprise a number of large factory units on a site totaling about 150 acres.

Yonkers, N. Y.—In addition to its new electric station to cost about $200,000, construction of which was recently announced, the Yonkers Electric Light & Power Co. is having plans for another similar plant on a local site to cost about $150,000, including equipment. W. Whitehill, 32 Union square, New York City, is the architect and engineer on the project.

Bayonne, N. J.—As a termination of a long postponement of a new "white way" street-lighting system, the city commission has voted to provide such installation along Broadway between Fifth and 18th streets, and 24th and 52nd streets. Property owners along this thoroughfare presented a petition to the commission urging the action.

Clayton, N. J.—The borough council has issued an order requiring the local electric power company to replace all lines in the municipality where the insulation has been worn by contact with trees. It is set forth that payment for service will be withheld until the order has been complied with.

Clinton, N. J. — The New Jersey Power & Light Co. is extending its lines to this section, for light and power distribution. Service will be rendered from the company's plant at Dover.

Freehold, N. J.—The State Board of Public Utility Commissioners has granted permission to the Monmouth Lighting Co. to raise its rate for electric power to the Jersey Central Traction Co., from 1½ cents to 2 cents per kw.-hr. The board holds that the existing rate "is unduly low, and besides being insufficient and discriminatory, can only result in an undue burden upon the other customers of the company."

Lakewood, N. J. — In connection with proposed foreclosure proceedings by bond holders of the Trenton, Lakewood & Seacoast Railway Co., a proposition is under way for an extension to the line by the controlling interests from Lakewood to Point Pleasant. The original plans called for a line between these points, with further extension to Trenton, but construction was stopped by the war.

Morristown, N. J. — The Morris County Traction Co. has made application to the State Board of Public Utility Commissioners for permission to sell its power plant at Chatham to an industrial concern for a consideration of $18,000. The plant was constructed in 1911 at an actual cost of $16,000 and was abandoned after three-years' use, and has since been idle. The traction company, dating from 1914, has been purchasing power from the Morris & Somerset Electric Co.

Newark, N. J.—The Osborne Co., 759 Summer avenue, is having plans prepared for the erection of a power plant at its lithographing factory to cost about $50,000. It will be used for factory service.

Newark, N. J.—The Schofield Oil Co., Avenue R, has filed plans for the erection of a power plant, 31 by 91 ft. in connection with the construction of an addition to its works to cost about $30,000.

Paterson, N. J.—Royal Hasco, Inc., Peel street, has arranged the immediate construction of a one-story boiler plant at its textile works to cost about $25,000.

Passaic, N. J.—The Manhattan Rubber Manufacturing Co., 120 Broadway, New York City, is planning the erection of a steam-operated, electric power plant at its rubber goods factories on Willett street.

Pompton Lakes, N. J.—The borough council has approved the immediate installation of an electrically operated fire alarm system.

Trenton, N. J.—The State Board of Public Utility Commissioners has

granted permission to the Tri-County Electric Co. to issue securities for $17,800 for proposed extensions to its distributing lines. The company operates in Pequannock township and has been securing its power from the the municipal plant at Pompton Lakes for retail distribution.

Trenton, N. J.—The city commission is planning for the installation of new electrically operated pumping machinery at the municipal pumping plant on Calhoun street, with capacity of 25,000,000 gals. a day. A 1000-hp. steam turbogenerator will also be installed. The new equipment is estimated to cost about $75,000.

Allentown, Pa.—In connection with its ice manufacturing plant, now in course of erection at 17th street and Sumner avenue, the Allentown Rapid Service Co. will build an engine and boiler plant. Considerable electrical and mechanical equipment will also be installed in different departments of the works for operation, including ice-making machinery, motors, etc. The structure will be 125 by 161 ft., and is estimated to cost about $130,-000.

Donora, Pa.—The American Steel & Wire Co. plans the erection of an ore dock at its local plant, as well as a new unloading dock for coal. The structures will be provided with electrically operated hoisting, conveying and material-handling machinery.

Harrisburg, Pa.—No less than 125 applications have been received recently by the State Public Service Commission, covering the organization of electric light and power companies to operate in the state territory west of the Allegheny mountains. The commission will act upon the applications at an early date. A number of similar applications have also been received from new companies forming in Mercer county.

Johnstown, Pa. — The Conemaugh Power Co. has filed application with the State Public Service Commission for permission to issue stock for $500,-000, to be used for extensions, improvements, etc.

Johnstown, Pa.—The Cambria Steel Co. has commenced construction on a two-story addition to its plant, 61 by 240 ft., to cost about $75,000. The structure will be equipped as an electric repair shop.

Palmerton, Pa. — The Palmerton Lighting Co. is planning improvements in its system to cost about $17,-000. Application for permission to issue stock to this amount has been made to the State Public Service Commission.

Philadelphia, Pa.—The Enterprise Manufacturing Co., manufacturer of hardware specialties, with plant on Dauphin street, has arranged for the erection of an engine and boiler plant, 50 by 73 ft., to cost about $28,000.

Philadelphia, Pa.—The Foss-Hughes Co., 21st and Market streets, is planning extensions and improvements in its power plant at its local works.

Philadelphia, Pa. — D. F. Waters, operating a dye works at 53 Wister street, has filed plans for extensions and improvements in his power house to cost about $25,000.

Pittsburgh, Pa. — The West Penn Power Co. has made application to the State Public Service Commission for permission to issue stock for $75,-000, for proposed extensions and betterments in its system.

Pittsburgh, Pa. — The Duquesne Light Co. has secured permission from the federal authorities to install two high-tension electric transmission systems over the Allegheny river at a point near Colfax station, Allegheny county, to Plum township, Westmoreland county. The installation will be made to conect the Colfax power plant of the company with its substation at Woodville.

Pittsburgh, Pa.—The Beaver County Light Co. has made application to the State Public Service Commission for permission to issue bonds for $33,-500, for proposed extensions and improvements in its system.

Baltimore, Md.—The Chesapeake & Potomac Telephone Co. will erect a suburban exchange station on Kate avenue, near Garrison street, two-story, 75 by 86 ft., to cost about $120,-000. The contracts for the building has been let to Frainie Brothers & Haigley, 18 Clay street.

Baltimore, Md. — The Western Maryland railroad will erect an electric substation at Port Covington, to be used for the operation of its coaling pier, construction of which has recently been commenced. The substation will be built and operated in the name of the Western Terminal Co., a subsidiary organization.

Cumberland, Md. — The Baltimore & Ohio railroad, Baltimore, is said to be planning the electrification of 17 mi. of line, covering a heavy grade extending from Piedmont west to Altamont,, Garrett county. J. H. Davis is chief electrical engineer for the company.

Frederick, Md. — The Maryland School for the Deaf will install a power and heating plant at the institution to cost about $25,000.

Laurel, Md.—The borough officials are considerin~ alterations and extensions in the municipal electric power plant. C. L. Reeder, 200 West Saratoga street, Baltimore, is the engineer in charge of the plans.

Oakland, Md. — The borough officials are arranging the installation of a new electric light and power system to cost about $50,000.

Amherst, Va.—The borough council is considering preliminary plans for the erection of a municipal electric lighting plant.

Grafton, W. Va. — The trustee in bankruptcy for the Grafton Light & Power Co., and the Grafton Traction Co., will hold a sale of the properties on July 14. The proposition to merge the properties with larger interests in the vicinity has been abandoned by the syndicate formed for the purpose.

Arlington, Ga.—The Baker County Power Co. is planning the construction of a hydroelectric power plant on the Notchway river, near Larks shoals, with initial capacity of about 25,000 hp. W. E. Saunders is the manager of the company.

Davisboro, Ga.—The borough council has arranged a bond issue of $15,-000 for the installation of a municipal electric light and power plant.

NORTH CENTRAL STATES.

Cincinnati, O.—The Lunkenheimer Co., manufacturer of valves, steam specialties, etc., has awarded a contract for the erection of a one-story addition to its plant, 350 by 400 ft., to cost about $400,000.

Dayton, O. — The Dayton Pump & Manufacturing Co. has increased its capital stock from $1,000,000 to $1,-300,000.

Findlay, O.—The Differential Car New York City, has purchased from the government the plant formerly operated by the Grant Motor Co., and will equip the works for the manufacture of electric dumping cars, dumping bodies for electric trucks, etc.

Massillon, O. — The Enterprise Aluminum Co. has increased its capital stock from $50,000 to $500,000.

St. Bernard, O.—The Ideal Pattern Works has had plans prepared for a two-story and basement factory, 48 by 75 ft., to cost about $15,000.

Toronto, O. — The Follansbee Brothers Co., Pittsburgh, Pa., will build a new power plant at its Toronto works.

Michigan City, Ind.—The American Iron & Steel Corp., recently incorporated in Delaware with $50,000,000 capital, plans the erection of a steel plant on Lake Michigan. The initial construction program will involve expenditure of between $5,000,000 and $10,000,000 and will include the erection of blast furnaces, open hearth and sheet mill plants. Later it is planned to build tube, rod, bar and wire mills.

Muncie, Ind.—The Delaware Aluminum Co. has commenced the erection of a one-story machine shop and foundry to cost about $20,000.

Battle Creek, Mich.—The Rich Steel Products Co. will build a branch plant at Los Angeles, Cal. The first unit will be a one-story, 90 by 400 ft., building, where 500 men will be employed.

Charlotte, Mich.—The plant of the Charlotte Iron & Metal Co. was recently damaged by fire.

Detroit, Mich.—The Fruehauf Trailer Co., 1375 Gratiot avenue, is planning for the purchase of new machine shop equipment.

Detroit, Mich.—The Burroughs Adding Machine Co. has let contracts for additions to its Canadian plant at Walkerville, Ont.

Detroit, Mich. — The International Metal Stamping Co. is having plans prepared for a one-story, 79 by 532 ft. additional and a two-story, 17 by 85 ft. addition.

Grand Rapids, Mich. — The Oliver Machinery Co. has completed plans for a one-story brick and steel addition to its foundry, to cost about $50,-000.

Hamtramck, Mich. — The Briggs Manufacturing Co. plans the erection of a one-story, 80 by 83 ft., power house.

Jackson, Mich. — The Consumers Power Co. is planning the erection of a new power plant.

Pontiac, Mich.—An addition to the engine plant of the Oakland Motor

Car Co., a General Motors Corp., subsidiary, has been authorized at an estimated cost of $3,000,000.

Sheboygan, Wis.—The Jenkins Machine Co. plans a two-story, 150 by 200 ft., addition to its machine shop.

Waupaca, Wis. — The Jorgenson Manufacturing Co., manufacturer of automotive equipment, has started construction work on its new building program, the first unit to be 60 by 150 ft.

Duluth, Minn. — The Great Northern Power Co. has been authorized to construct a new dam to create a reservoir for developing additional electric power.

Sioux City, Ia.—The General Manufacturing Co. plans the erection of a four-story, 100 by 100 ft. plant, to cost $125,000.

St. Louis, Mo.—The Blanton Manufacturing Co., Second and Spruce streets, will equip a power plant in connection with its new addition to cost about $225,000. The installation will comprise four 350-hp. boilers, electric generators, coal and ash handling machinery, refrigerating equipment and other apparatus. David A. Blanton is the president of company.

Bancroft, S. D.—The city will hold a special election to vote on the insuance of $7500 in bonds to be used for improving the lighting facilities in the city.

Watertown, S. D. — A municipal bond issue of $200,000 has been authorized for a new distributing system and extensions in the municipal electric light plant.

SOUTH CENTRAL STATES.

Louisville, Ky. — The P. Bannon Pipe Co. has awarded a contract for a two-story and basement addition, 71 by 106 ft., to cost about $70,000.

Louisville, Ky.—The Louisville Gas & Electric Co. is planning the early rebuilding of its power plant at Echols, Ky., recently destroyed by fire.

Centerville, Tenn. — The common council is considering the establishment of a municipal electric lighting plant.

Memphis, Tenn.—The Dixie Rubber Co., 770 Randolph street, will build a power house in connection with the new $175,000 plant the company is erecting.

Florence, Ala.—The Burcham Valley Telephone Co., recently organized, is planning for the installation of a system in different parts of Lauderdale county.

Mobile, Ala. — The federal government plans the expenditure of about $400,000 in the construction of a coal-handling plant on the Alabama river.

Trussville, Ala.—The Alabama Silica Products Co. will install stone grinding machinery, conveyors, loading apparatus, etc., in connection with its recently acquired works in this section. Much of the new machinery will be electrically operated. E. D. Jordan is the president and manager of the company.

Conway, Ark.—The borough council is arranging the installation of a new generator and engine, with auxiliary equipment at the city electric lighting plant on Conway avenue. Other improvements will also be made, and an initial bond issue of $12,000, has been voted for the work.

Hope, Ark.—The Eclipse Manufacturing Co., manufacturer of structural steel specialties has increased its capital stock to $100,000.

Pascagoula, Ark. — A contract has been awarded by the Modern Welding & Machine Co. for a machine shop and foundry.

WESTERN STATES.

Las Vegas, N. M.—The city plans improvements in its street-lighting system.

Hailey, Ida.—The Greene Construction Co., of Salt Lake City, Utah, is making estimates on the construction of a hydroelectrical plant on the east fork of the Wood river to furnish power for the Mascot mine and mill, located 5 mi. north of the proposed plant.

Redding, Cal.—The Pacific Gas & Electric Co. will erect its third power unit in Shasta county on Pitt river, 4 mi. downstream from the Fall River mills.

San Jose, Cal.—The National Axle Co. will build a plant at an estimated cost of $130,000.

CANADA.

Vancouver, B. C.—Plans are to be prepared for the establishment of a $12,000,000 hydroelectric plant at Seton lake.

Walkerville, Ont. — The Hiram Walker Sons, Ltd., has let a contract to R. Wescott & Co., Sheppard street, Windsor, Ont., for the erection of a power plant to cost $175,000.

Welland, Ont.—The Ontaria Smelters & Refiners, Ltd., plans making additions to its smelter plant.

INCORPORATIONS.

Buffalo, N. Y.—The Becker Electrical Appliance Co. Capital stock., $5000. To manufacture electric equipment of various kinds. Incorporators: A. Becker, J. E. Carr, and E. J. Carney.

Brooklyn, N. Y. — The Liberty Phono Motors Corp. Capital stock, $12,000. To manufacture small motors and other electrical specialties. Incorporators: C. F. Hahn, J. J. and J. J. Baum, Jr., 1321 Gates avenue.

East Orange, N. J.—The Protecto Battery Filler Co. Capital stock, $600,000. To manufacture electric batteries and kindred equipment. Incorporators: Louis M. Sanders, Sr., and Jr., and H. L. Lund. The company proposes to operate a plant in this district.

Jacksonville, Fla.—The Holt Electric Co. Capital stock, $250,000. To manufacture electrical supplies of various kinds. Incorporators: Howard F. and Frank J. Smith.

Dover, N. J. — E. E. Yensel, formerly general manager for the New Jersey Power & Light Co., has organized the North Jersey Steel Co. with capital of $500,000, to operate iron ore properties in this section. Harry M. Roche and Jesse C. Stoddard are also interested in the company.

Los Angeles, Cal. — The Electric Motor Lock Corp. has been incorporated with capital stock of $100,000 to manufacture electrically operated locks. B. M. Caldwell, J. H. Rodorf and G. B. Caldwell are the incorporators.

Winnipeg, Man.—The Home Appliances Manufacturing Co. has been incorporated with capital stock of $250,000, by John R. Campbell and others.

Montreal, Que. — The Providence Electric Heating Co., Ltd., has been incorporated with capital stock of $500,000 to manufacture electric stoves, etc. Joseph W. Guimont, Louis P. Methe, Henri Barnard and others are the incorporators.

Louisville, Ky. — The Automatic Light Switch Co. has been incorporated with capital stock of $50,000. J. W. Roberts, C. I. Pickrell and W. L. Scott are the incorporators.

Dallas, Tex.—The Dallas Elevator & Electric Co. has been incorporated with capital stock of $35,000. W. O. Parker, E. B. Thomas and A. C. Bookout are the incorporators.

Brooklyn, N. Y. — The Detecting Wire Corp. Capital stock, $1,000,000. To manufacture electric wires and other equipment. Incorporators: John S. Roberts and James G. Booth, Brooklyn; George Murray Brooks, New York.

Brooklyn, N. Y.—The Braun Gear Corp. Capital stock, $10,000. To manufacture engines and boilers. Incorporators: A. M., J. J., and J. J. Braun, Jr., 1321 Gates avenue, Brooklyn.

New York, N. Y.—The Gasgo Power Corp. Capital stock, $25,000. To operate electric light and power plants. Incorporators: L. E. Vollmer, C. J. O'Connor and N. B. Jacques, 1238 Bushwick avenue, Brooklyn.

Syracuse, N. Y. — The Syracuse Electric Sun Signs, Inc. Capital stock, $35,000. To manufacture electrically operated displays. Incorporators: C. D. Winters, K. R. Morgan and W. B. Masters, Jamaica, L. I.

Newark, N. J.—The Electric Box & Cover Co. Capital stock $125,000. To manufacture electric switches, cut-outs, etc. Incorporators: Emanuel Shaw, W. L. Greenbaum and Jacob Lubetkin, all of Newark.

Boyerstown, Pa.—The Boyerstown Electric Supplies Co. Capital stock, $5000. To manufacture electrical specialties. E. W. Rennert, Philadelphia, is the principal incorporator.

Bethlehem, Pa.—The Boyer Electric Co. Capital stock, $15,000. To manufacture electric equipment. Incorporators: James E. Mathews, Dallet H. Wilson and Harry Boyer, Bethlehem.

Baltimore, Md. — The Commercial Excelite Co. Capital stock, $40,000. To manufacture electric and gas equipment and appliances. Incorporators: Louis M., Harry and Irving Rubin, 312 North Eutaw street.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

American Traction & Light Co. May Reduce Dividend.

The directors of the American Light & Traction Co., one of the largest public utility corporations in the United States, will hold their meeting within the next few days and, it is reported, reduce the regular quarterly dividend on the common stock.

The company has been paying a 2½% stock dividend in addition to a 2½% cash dividend on the common stock every three months since 1910, or at the annual rate of 20%, 10% in cash and 10% in stock.

It was the first large company in this country to adopt the policy of distributing a portion of its surplus to stockholders as new stock. It will not be definitely decided until the directors' meeting to what extent the dividend will be reduced. One or two directors favor maintaining the regular disbursement this quarter in the hope of better conditions developing shortly, but the majority of the board favor a more conservative policy.

Interests close to the company are confident that the directors will reduce the dividend to 8% in cash and 8% in stock. Only one director, who is considered ultra-conservative, favors a cut to 6% cash and 6% in stock.

The stock of the American Light & Traction Co. has had a checkered career in Wall street, selling one time at over $410 a share. It is not listed in the exchange now and is quoted by outside houses at $120.

Interests close to the company point out that on an 8% cash and 8% stock dividend basis the stock at $120 will yield over 14%.

The American Light & Traction Co. is a holding company, owning over 99% in stock in some sixteen prominent public utility corporations throughout the country, principally in the Middle West. The management has always adopted a conservative attitude toward dividends and believes that curtailment is necessary at present.

Bankers See Credit Improvement During Summer.

Bankers are of the opinion that the credit situation will display marked improvement within the next week or ten days. They elaborate on this assertion further by saying that money rates will be fairly stable during the months of July and August.

The present fluctuations in the call money market are regarded as temporary only, and due to no other reason than the result of the large government banking transactions incident to tax payments and treasury certificate operations this month. A large number of tax checks are now coursing through the banks and in many cases banks are now aware of the extent to which they were drawn upon for this purpose. This situation will clarify, they say, within the next few days, when the money market should settle down to a more normal state.

They emphasize that what are regarded as "easy" money rates cannot be expected with a Federal Reserve bank rate of 7%, but they feel that call money should hold around the 7% level for at least two months during the summer, and that there should be no visible stiffening of rates until the crop demands are felt. These requirements do not appear as a rule until the latter part of August or the first week in September. While there may be slight fluctuations in call money rates, the general tendency is expected to be what might be termed "better."

Between now and the fall a large amount of foreign gold is sure to be imported, and this metal will also tend to ease the situation.

The commercial demand for credit continues large, but bankers maintain that these accommodations are being extended to industrial concerns desirous of promoting the manufacture of essential lines.

Bankers all over the country are acquainting their clients with the need for reducing their credit requirements wherever possible, and are gratified at the cooperative attitude displayed in all quarters.

Speculative commodity loans are being reduced materially, and this liquidation will soon be visible in the money markets. As one banker explained the situation: "The Reserve bank rates are not inaugurated to actually promote deflation, but are looked upon to curb inflation."

Shawinigan Water & Power Co. to Issue Notes for Expansion.

The Shawinigan Water & Power Co. has arranged for a note issue, the proceeds to be used in part for proposed extensions and betterments in the electric plants and system of the company. The company is one of the largest producers of hydroelectric power in Canada and serves a population at Montreal and Quebec of about 1,500,000 persons, or equal to about 17% of the population of Canada. The main plant of the company is at Shawing, Shawinigan Falls, St. Maurice river.

Idaho Power Co. Arranges Bond Issue of $2,000,000.

The Idaho Power Co., 71 Broadway, New York City, with general offices at Boise, Ida., has arranged for a bond issue of $2,000,000, to be used for proposed extensions, betterments and general finances. The company is now serving a territory with population of about 160,000 persons. All plants are of hydroelectric type, situated on the Snake river. The present aggregate generating capacity is 39,540 kw.

Cleveland Electric Illuminating Co. Sells Bonds.

William A. Read & Co., Nassau and Cedar streets, New York City, bankers, has sold a bond issue of $5,000,000 in first mortgage bonds for the Cleveland Electric Illuminating Co., Cleveland, Ohio. The proceeds will be used by the company for the erection of additions to its present generating plants for increased capacity, extensions in transmission and distributing lines, and other new revenue-producing expenditures.

Adirondack Electric Power Corp.

	1920.	1919.
May gross	$ 160,011	$ 130,025
Net after taxes	84,015	60,005
Surplus after charges	56,839	38,832
Twelve months' gross	1,931,152	1,796,708
Net after taxes	711,240	475,406
Surplus after charges	385,866	212,740

Detroit Edison Co.

	1920.	1919.
May gross	$1,669,921	$1,210,340
Net earnings	291,021	295,610
Surplus after charges	100,757	156,106
Five months' gross	8,701,199	6,651,306
Net earnings	1,938,623	1,888,101
Surplus after charges	1,054,111	1,201,419

Dividends.

The Public Service Corp. of Quebec, a subsidiary company of the Shawinigan Water & Power Co., has declared its quarterly dividend of 1¼%, payable July 15 to stockholders of record June 30.

The Harrisburg (Pa.) Light & Power Co. has declared its regular quarterly dividend of 1½% on its preferred stock, payable June 30 to stockholders of record June 16.

The Westinghouse Electric & Manufacturing Co. has declared its regular quarterly dividend of 2% ($1 per share) on the preferred stock of the company, payable July 15 to stockholders of record June 30. A similar dividend has also been declared on the common stock, payable July 31 to stockholders of record June 30.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid June 22.	Bid June 29.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	10	10
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	110	105
American Gas & Electric of New York, preferred	6	37	36
American Light & Traction of New York, common	..	125	124
American Light & Traction of New York, preferred	6	79	79
American Power & Light of New York, common	4	49	45
American Power & Light of New York, preferred	6	63	65
American Public Utilities of Grand Rapids, common	..	4	4
American Public Utilities of Grand Rapids, preferred	7	12	12
American Telephone & Telegraph of New York	..	102	92½
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	8	6
American Water Works & Elec. of New York, first preferred	..	38	35
Appalachian Power, common	..	2	2
Appalachian Power, preferred	7	15	15
Cities Service of New York, common	+extra	325	325
Cities Service of New York, preferred	6	64	65
Commonwealth Edison of Chicago	8	101	102
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	38	39
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	41	42
Middle West Utilities of Chicago, common	..	18	18
Middle West Utilities of Chicago, preferred	..	34	35
Northern States Power of Chicago, common	..	34	32
Northern States Power of Chicago, preferred	ex.div.7	76	78
Pacific Gas & Electric of San Francisco, common	..	60	46
Public Service of Northern Illinois, Chicago, common	7	76	75
Public Service of Northern Illinois, Chicago, preferred	6	79	78
Standard Gas & Electric of Chicago, common	..	13	13
Standard Gas & Electric of Chicago, preferred	6	34	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3	3
United Light & Railways of Grand Rapids, common	4	19	20
United Light & Railways of Grand Rapids, preferred	6	57	57
Western Power of San Francisco, common	..	14	14
Western Union Telegraph of New York	extra	82	80
Industrials—			
Electric Storage Battery of Philadelphia, common	4	102	100
General Electric of Schenectady	8	130	140
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54	53